fancy guppies...

for the advanced hobbyist

by drs. c. w. emmens and herbert r. axelrod

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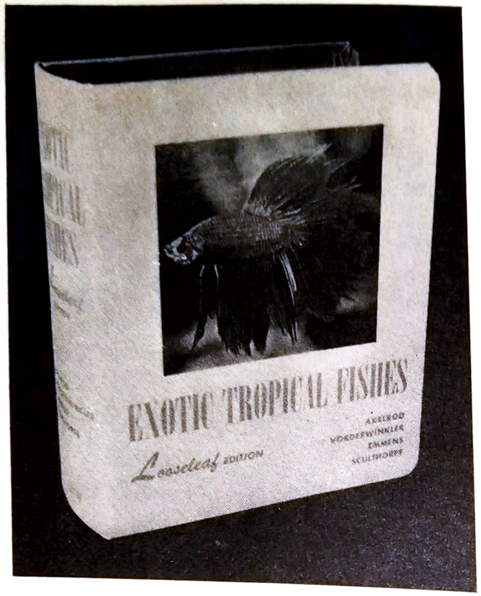

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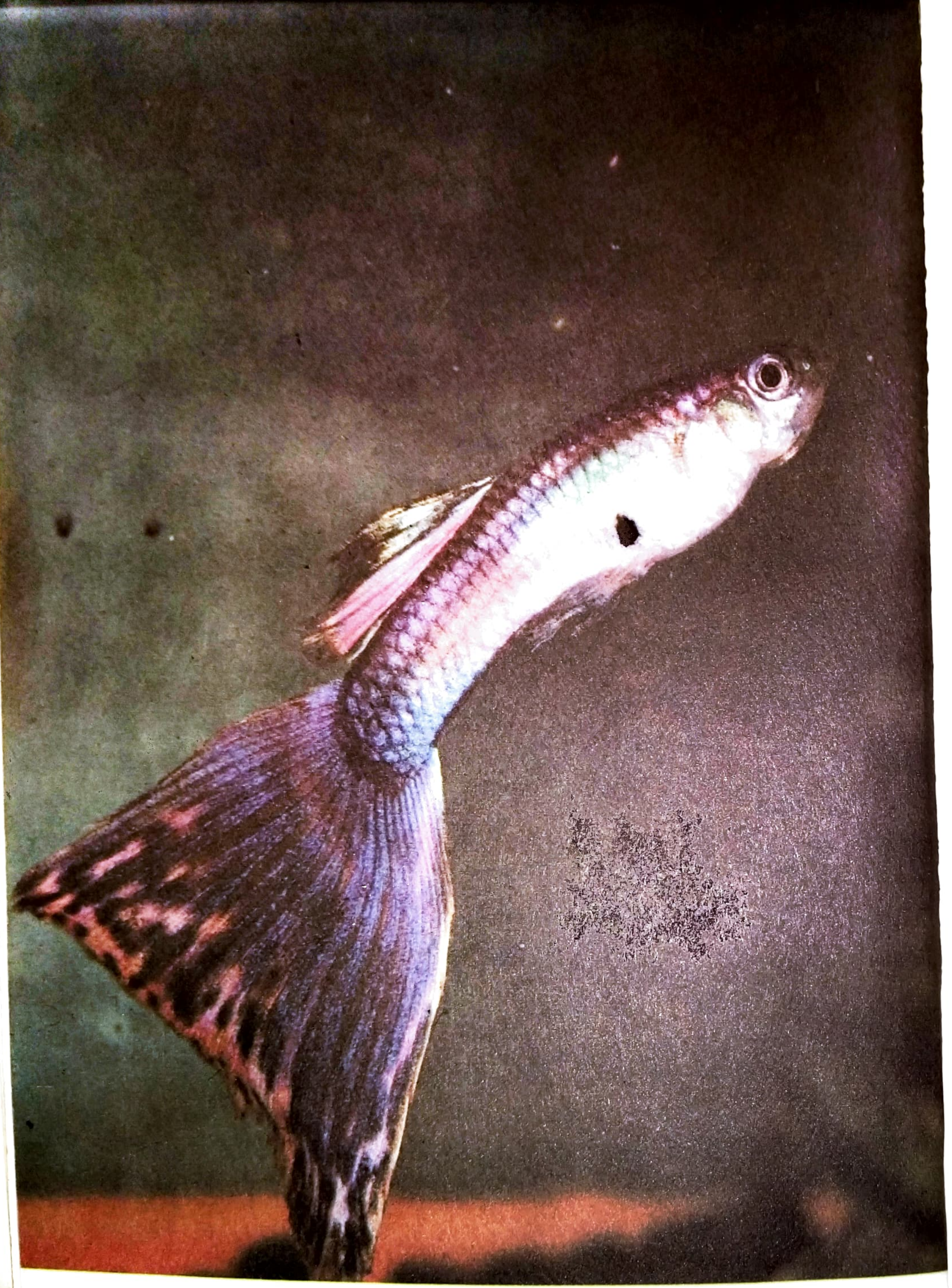


The fancy guppy, beauty plus, is represented here by the most popular type, variously known as the veil tail, delta tail and fan tail guppy. Photo by Hansen.

Sports, or fish bearing visible mutations, show up fairly regularly in guppies. Here we see the extension of several rays of the caudal fin. Photo by Dr. Herbert R. Axelrod.

Introduction

The guppy is one of the oldest of the tropical aquarium fishes, being first described from Venezuela in 1859 and imported into Europe in 1908. It was rapidly distributed to England and the United States. The development of the modern fancy varieties of guppy, however, has been extraordinarily delayed and the last decade has seen much bigger changes than any in the 50 years preceding it.

Any animal that has been bred in captivity over many generations will be throwing sports, or mutations, and this is the case with the guppy. However, the mutations described until fairly recently, although they were the subject of quite intense genetic studies in many parts of the world, were not such as to raise the enthusiasm of the aquarist because they were a series of rather minor changes in fin shape and fin or body coloration. They were used to work out a good deal about the genetics of the guppy, from which it was realized that some characteristics of the male guppy are not visible in the females; some are transmitted only from mothers to sons and others are sex-linked, being carried only by the Y chromosome of the male. Except in some modern varieties of guppy in which the females do show a fair amount of color, all color and all fancy finnage characteristics are either sex-linked or sex-limited and normally show up only in the male fish.

In a previous T.F.H. booklet the late Myron Gordon has given an account of the genetics of the guppy, using the rather uninspiring characteristics referred to above. It is very interesting that the so-called fancy guppies figured on page 25 and elsewhere in Gordon's booklet, which was first published in 1955, are miserable specimens which would be among the culls of any respectable guppy breeder of the present day. Part of the changes have followed the more intensive and intelligent use of genetic knowledge, but the care and the feeding of the animal in this particular instance is just as important as its genetic constitution for full development of color, finnage and body size. It is for this reason that the present booklet will start with quite a bit about the keeping of guppies before going on to a discussion of modern methods of breeding and of the strains produced by them. An elementary knowledge of fish keeping, of breeding in the live-bearers and of the genetics of the guppy will be assumed.

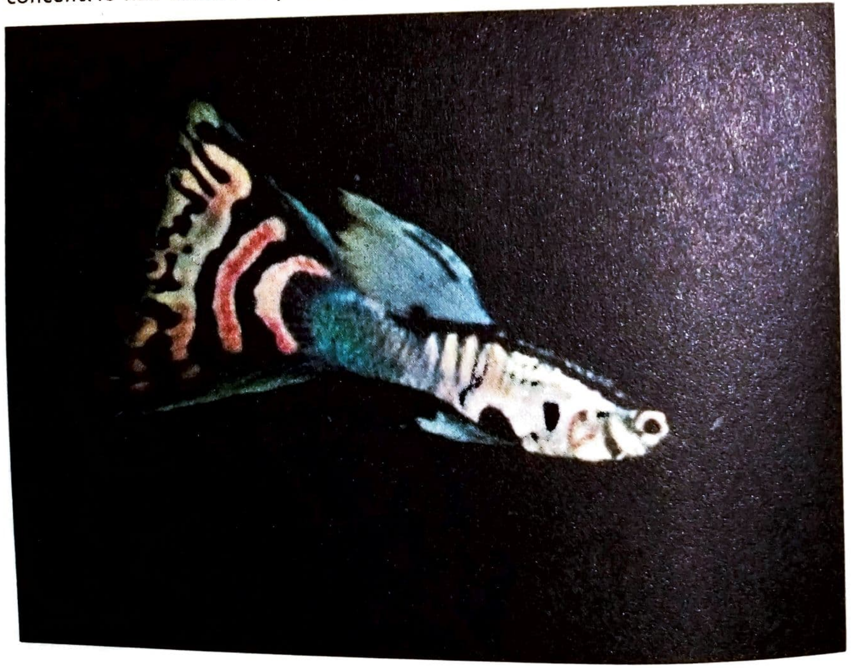
A number of young fancy guppies. They include a female and scarf tail and double sword tail males.

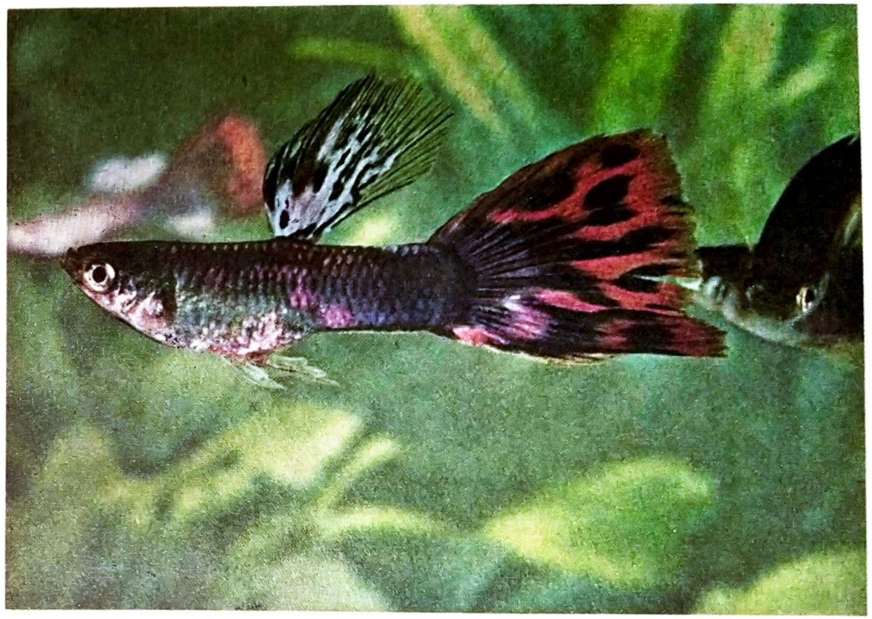
Sternke's strain of double sword tail guppies. Photo by M. F. Roberts.

Keeping Guppies

A very considerable amount of work has been done by different aquarists, some of it on a scientific scale, in order to discover the optimum conditions for keeping various live-bearing fishes, particularly the guppy. Naturally, opinions differ and in this booklet a median view will be attempted, with some of the variables discussed in detail. It seems to be generally agreed that guppies are best bred in indoor tanks of moderate size and not in outdoor pools or in very large indoor tanks. At least one or two producers of outstanding guppies use, or have used, the outdoor pool method of breeding, but it is usually agreed that outdoor guppies are rangier, less compact and, in general, less pleasing to the eye even if they may be as large or as colorful as their indoor counterparts. The optimum tank size is between 10 and 20 gallons, with not more than four adult fish per gallon of water. In order to establish any kind of breeding program with guppies, several dozen such tanks will normally be needed, although an established strain could feasibly be maintained at an adequate level with perhaps as few as six or eight of them. In what follows, therefore, the use of the 10–20 gallon tank will be assumed, although this does not mean that for special purposes and holding, preferably only for short periods, it is not perfectly feasible to use smaller tanks. It seems unlikely, however, that really fine guppies will be produced if a program of breeding is attempted with smaller than 10 gallon tanks.

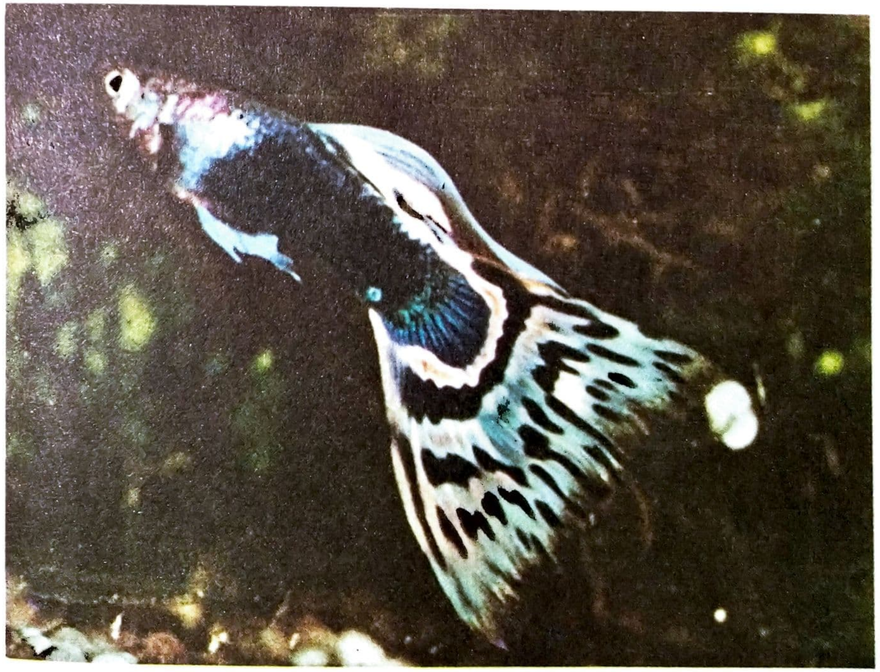
This fancy guppy is from Germany. Several strains from that country exhibit concentric half circles as part of the tail pattern. Photo by Dr. E. Schmidt.





Paul Hahnel of the United States is known as "the father of the fancy guppy." He earned that name by developing strains like the one above. Photo by M. F. Roberts.

The fish below is an outstanding specimen from Germany. Note the three-quarter black body and beautifully marked veil tail. Photo by Dr. E. Schmidt.

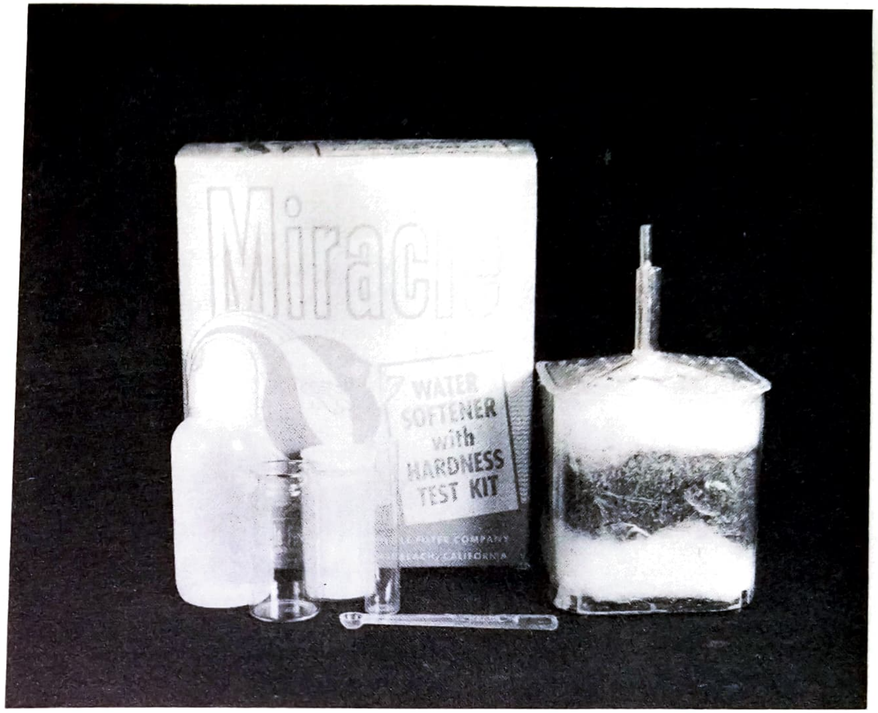


To test the acidity of your guppies' water, you must use a pH test kit of some kind. This one consists of a roll of indicator paper in a plastic case. You simply tear off a small piece of the paper and dip it into the aquarium water. The color that the paper changes to tells you the pH of the water. Photo courtesy Miracle Plastics Co.

WATER CONDITIONS

No fish should be transferred suddenly from one type of water to another. Many fine guppies have been bred in alkaline water, but it is generally agreed that water on the acid side is preferable. Some rather fine distinctions are made by some writers, who may advocate a pH of 6.5–6.8 for reds and 6.8–7.0 for blues, but generally speaking a pH of between 6.5 and 7.0 will be found to be satisfactory. Individuals accustomed to a higher pH should be gradually brought down to the desired range by any of the standard methods of adjusting the pH of aquarium water. The

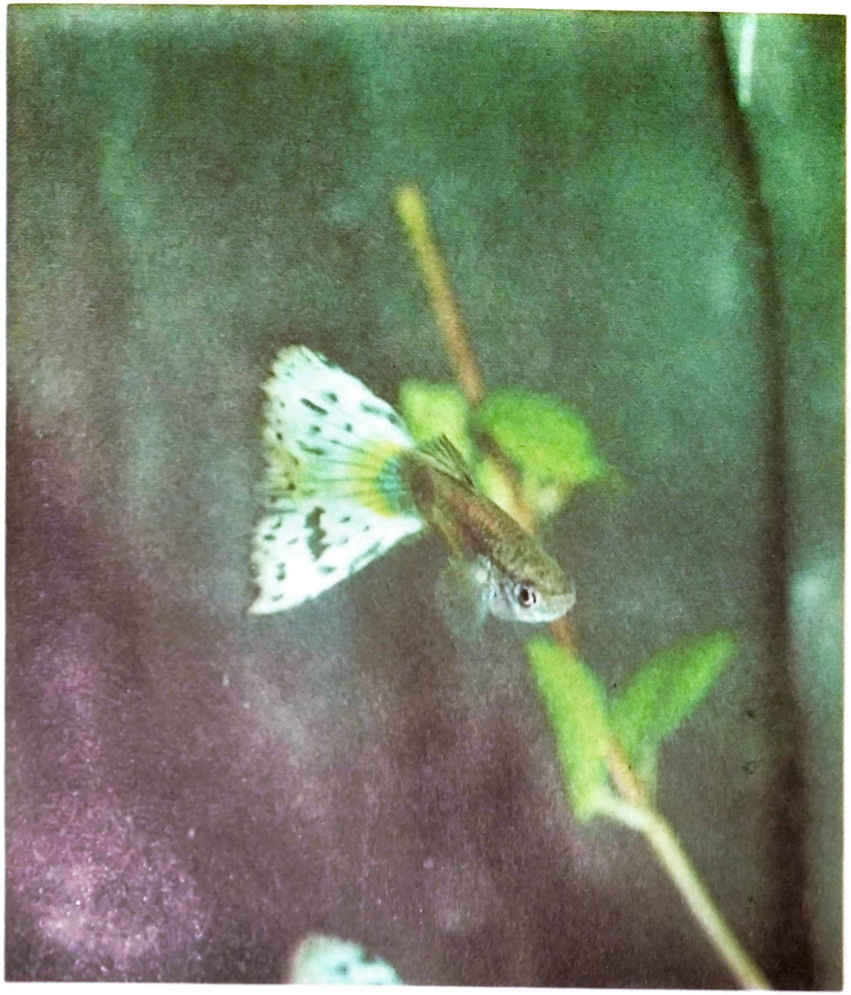
This pH test kit utilizes a liquid indicator. It also comes with chemicals with which you can adjust the pH in your tanks. Photo courtesy Miracle Plastics Co.



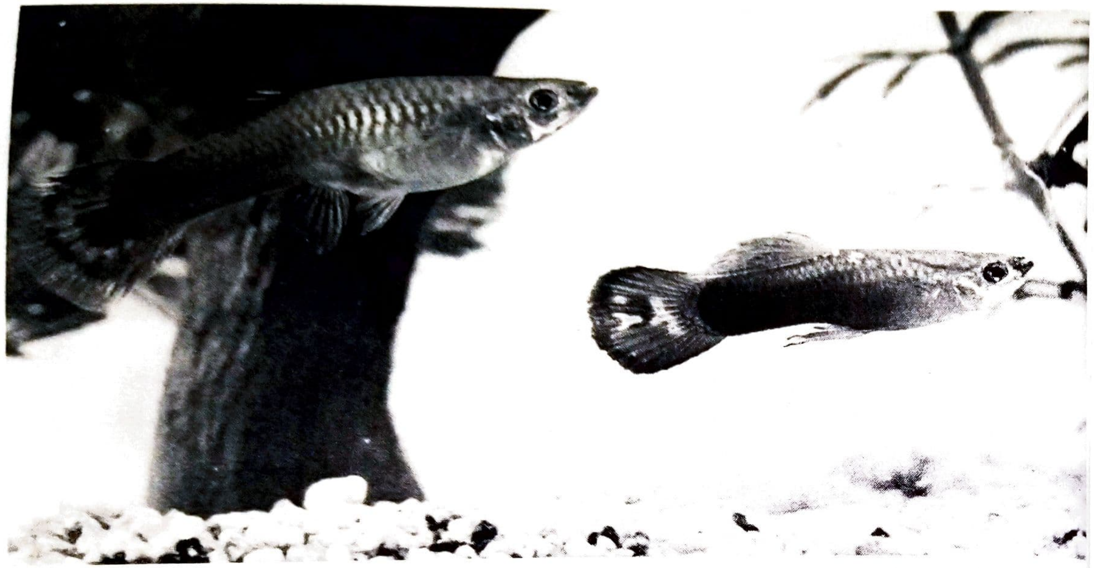
Kits are also available which not only allow you to test the hardness of your water, but also provide materials which can be placed in your filters to slowly soften it. Photo courtesy Miracle Plastics Co.

addition of up to a teaspoonful of salt per gallon of water (not iodized table salt, but crude rock salt or chemical sodium chloride) is also advisable. Again, guppies can be bred and fine specimens raised in very pure water, but the addition of this level of sodium chloride appears, in general, to be desirable. Medium-hard water is also best for guppies, about 6–10 degrees of hardness on the German scale. They are, however, quite tolerant of a wide range of salinity and hardness and rather colorful guppies can be maintained in brackish marine water or even full strength marine water if gradually brought to it. However, we are not discussing the great range of their tolerance, but the rather narrow limits within which it seems to be agreed that they must be maintained for best color, finnage and body development. The water in which the guppies are kept must be as clean as

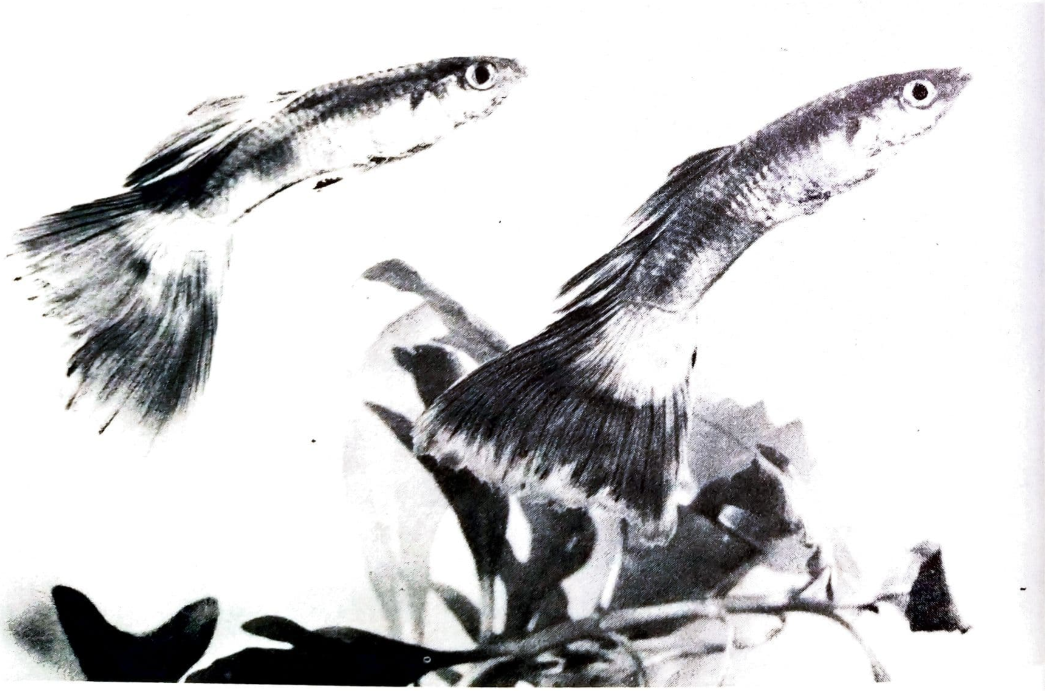
Light, almost-pastel coloration is being bred for by a number of sophisticated guppy lovers both in the United States and abroad. The guppies shown above and on the facing page are representatives of such a strain developed in Europe. Photos by Hansen.



possible and a regular change of water at the rate of up to 10% per week is recommended. The new water should fairly closely resemble the water in the tank as to the various qualities discussed above, but the tank water itself will take care of any minor variations at the time of admixing. A check should be kept, however, on the state of the water in guppy tanks as it is quite capable of gently drifting to an unsatisfactory pH, hardness or salinity, especially if gravel is utilized.



Above, a strain of half-black guppies in which the female also exhibits the coloration to some degree. This variety was developed in Czechoslovakia. Similar strains are available in the United States. Photo by R. Zukal. The fishes below illustrate how large fins can often weigh a fancy guppy down. Such males may have difficulty breeding, particularly if they are competing with smaller-finned males. Photo by G. J. M. Timmerman.

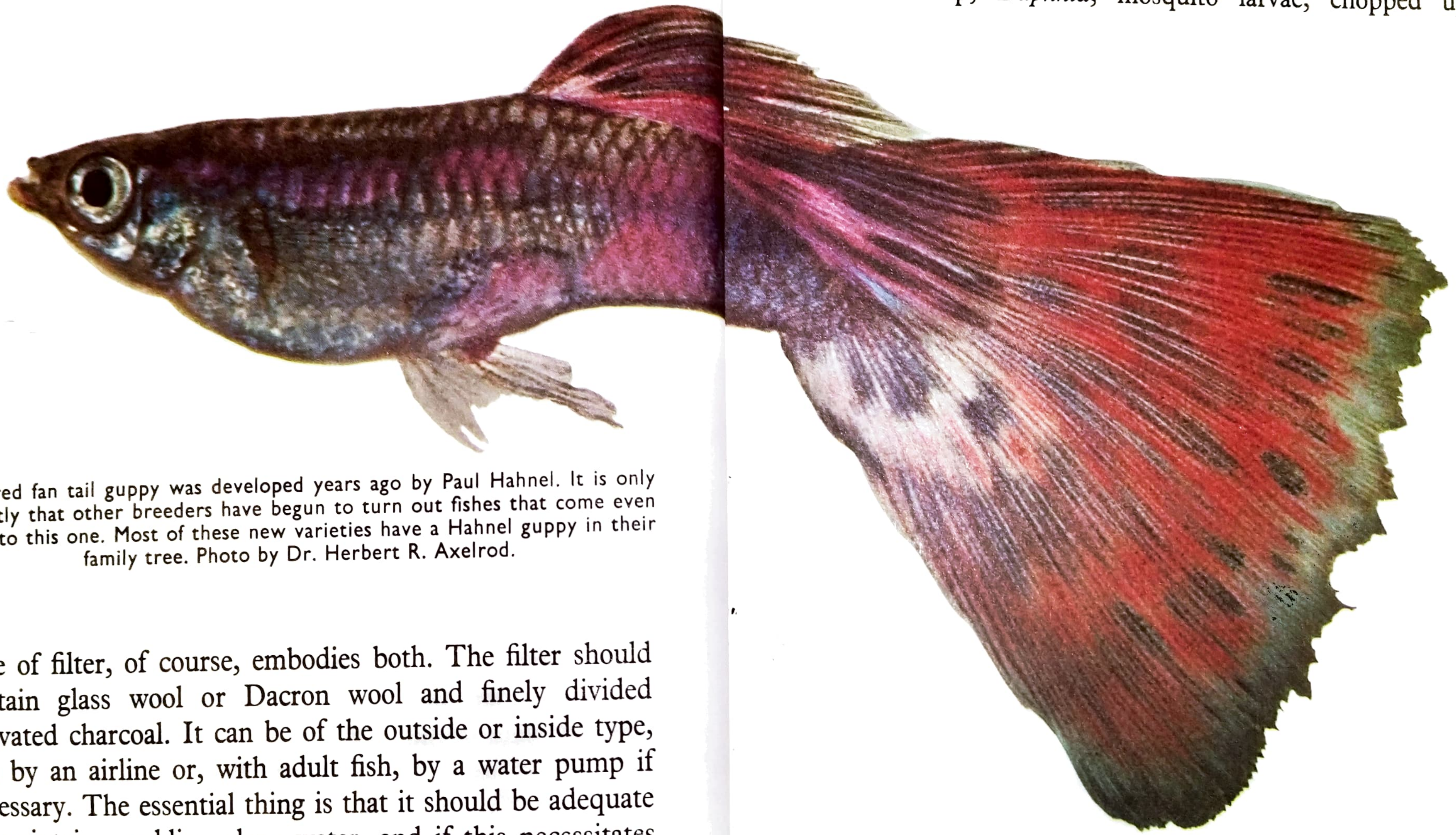


TEMPERATURE CONDITIONS

Guppies do best at a temperature of about 75–80°F., higher in the range when they are first born, somewhat lower after the first few weeks. They will be quite happy at anywhere between 65° and 85°, but once more we must stress that we are discussing conditions in which they *optimally* develop. Any changes in water temperature should, as usual, be made gradually, although an upward change can be tolerated to the extent of about 5° at a time. No great variation in water temperature should be allowed and with the rather small tanks in which guppies are to be kept care should be taken that there is no undue day to night fluctuation in temperature. An undetected swing of 6–8° over the 24 hour period has more than once been found to be the cause of disease or poor development. Generally speaking, the tank should be illuminated either naturally or artificially for about 12 hours per day, or even somewhat longer. This gives the fishes adequate time in which to feed, but the intensity of the lighting needed will depend on the presence or absence of growing plants more than upon any other factor.

Filtration

Quite a number of guppy fanciers dispense with gravel or plants completely. Others feels that the maintenance of growing plants is an advantage in the tank, not only from the point of view of the scenery, but because such plants are feeding upon waste material and are helping to maintain a healthy state in the aquarium. This is quite true as long as the plants are rapid growing varieties, such as the water sprite recommended by Paul Hahnel, and are well cared for so that they are an asset and not a detriment. Naturally the use of plants will normally require the addition of sufficient gravel at the bottom of the tank for them to be growing in, but the use of plants together with under-gravel filters will need very considerable care. The under-gravel filter is a very efficient oxygenator and purifier of the bottom of the tank, but it tends to rob the plants of their normal conditions and should be turned on only for a restricted period per day if the plants are to flourish. If plants are used it may not be necessary to filter the aquarium, but this is usually advocated even in their presence. If they are not used, then an adequate filtration and aeration system must be employed; many a type of filter, of course, embodies both. The filter should contain glass wool or Dacron wool and finely divided activated charcoal. It can be of the outside or inside type, run by an airline or, with adult fish, by a water pump if necessary. The essential thing is that it should be adequate to maintain sparkling clean water, and if this necessitates frequent changing of the filter materials, then that should be done. The more guppies one attempts to keep per gallon of water up to the limit cited, the more the filter will need to do.



This red fan tail guppy was developed years ago by Paul Hahnel. It is only recently that other breeders have begun to turn out fishes that come even close to this one. Most of these new varieties have a Hahnel guppy in their family tree. Photo by Dr. Herbert R. Axelrod.

Feeding

There are almost as many views of the best food for guppies as there are people who are serious guppy keepers. However, the great majority agree that an abundance of live food, or its near equivalent, freeze-dried food, should be used. It is best to use a variety of foods, such as tubifex, brine shrimp, *Daphnia*, mosquito larvae, chopped up

Under-gravel filters are preferred by many guppy breeders, because these filters cannot suck in fry and require virtually no care. The contoured type provides very great filtering area and considerable flexibility in landscaping. The flat type is particularly good in a non-display tank used for breeding or raising fry. Photos courtesy Miracle Plastics Co.

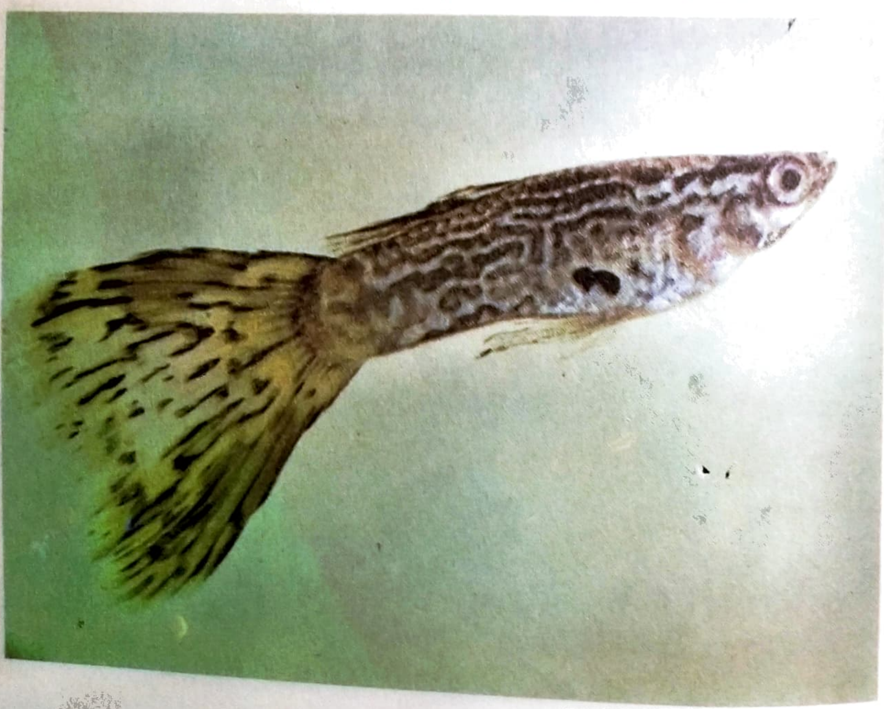
garden worms, chopped up tuna, crab or other fish meat, liver, beef, to which may be added vegetable components. Kaufman does not believe in vegetables in his prepared foods, but others feel them to be necessary. The essential thing about feeding is that it should be frequent and that the food should be clean. Tubifex may be an important part of the fishes' diet, but it will do them little good if it is not thoroughly clean before use. Thus we highly recommend freeze-dried tubifex. *Daphnia* are good fish food, but should not be fed exclusively. There seems to be a remarkably frequent opinion among those who should know better that *Daphnia* has little or no food value. This may apply to the dried *Daphnia*, from which most of the desiccated protein has fallen out in the form of dust on the floor of the distributor, but it is certainly not true of the living, freshly gathered crustacea. Dried food may be fed from time to time and a perfectly satisfactory program of feeding will include about as much dried food as fresh food. Various makes of very satisfactory dried food are available on the market, but it may be preferable to make one's own, particularly if a large number of animals are to be maintained. Gordon gave a useful formula in the booklet to which we referred previously.

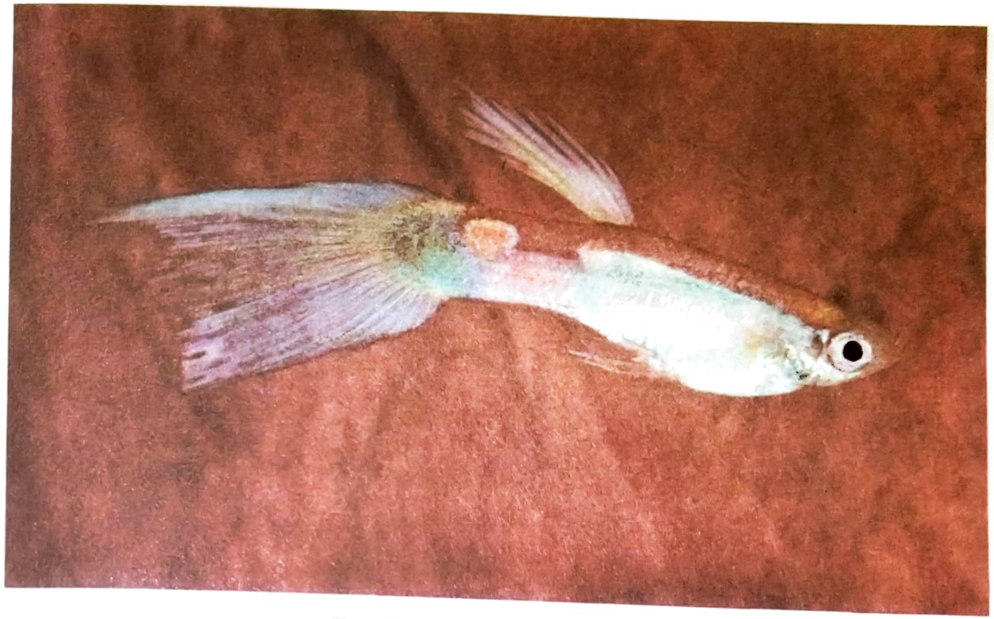
Feeding should be virtually as frequent as possible, at least 4–6 times a day. Ten times a day is not too frequent, but is clearly impracticable to many of us. There is little doubt, however, that if one is not able to feed guppies quite frequently then the best developed specimens can hardly be hoped for. Thus the businessman fancier must arrange for a member of his family, or a neighbor, to feed his guppies several times during the day if no-one else is at home. The

New foods and packaging innovations of the 1960's included Norwegian Brine Shrimp in a plastic covered can (with measuring spoon) and Fry Treet, a freeze-dried fry food, in a squeeze-bottle dispenser. Photos courtesy Miracle Plastics Co.

Good food is one of the keys to raising quality guppies. Freeze-dried foods are not only highly nutritious, but also are eaten in large quantities by guppies. This is particularly true of freeze-dried tubifex worms (photo courtesy Miracle Plastics Co.).

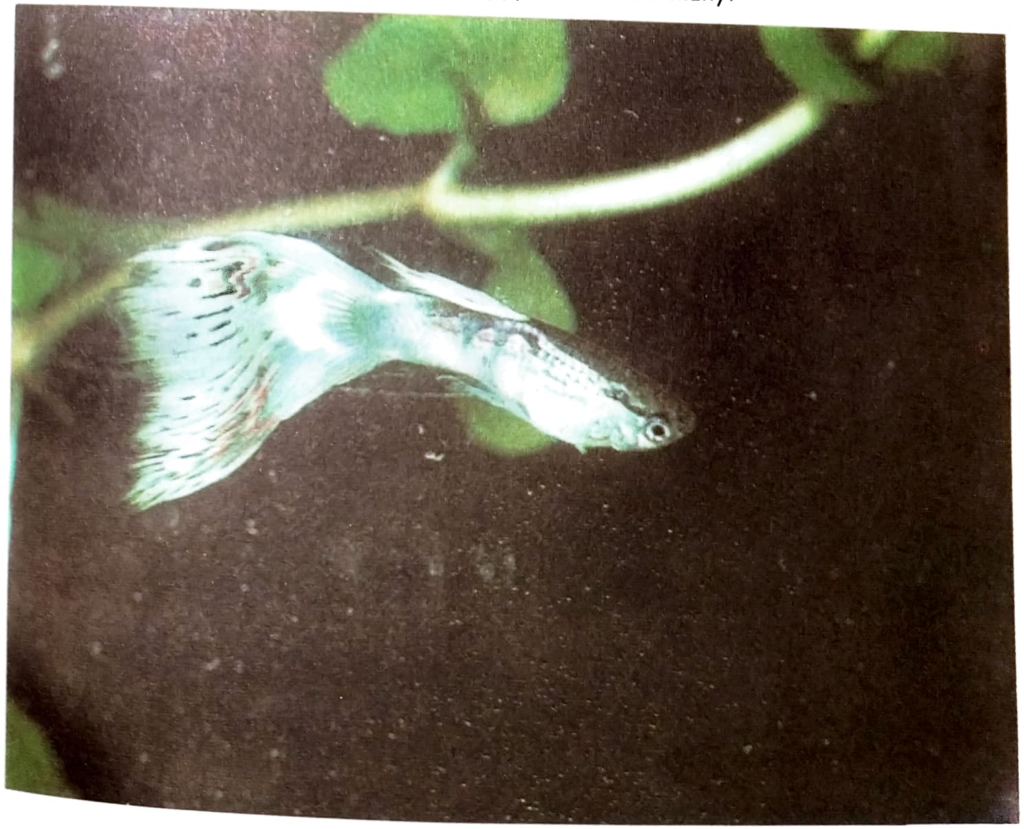
King Cobra guppy. Photo by Dr. Herbert R. Axelrod.





This fish is from Czechoslovakia.

This fantastic guppy is from Germany.

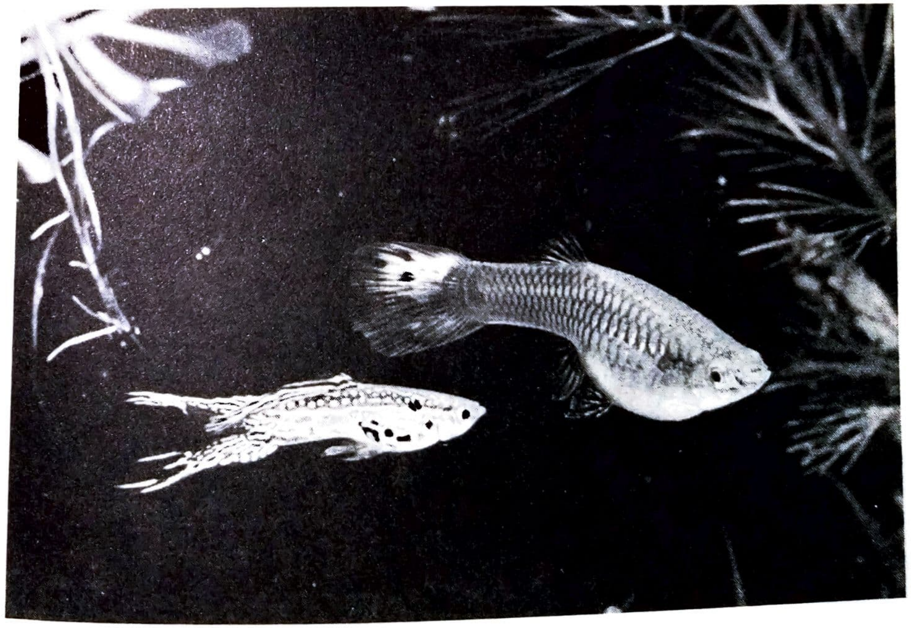


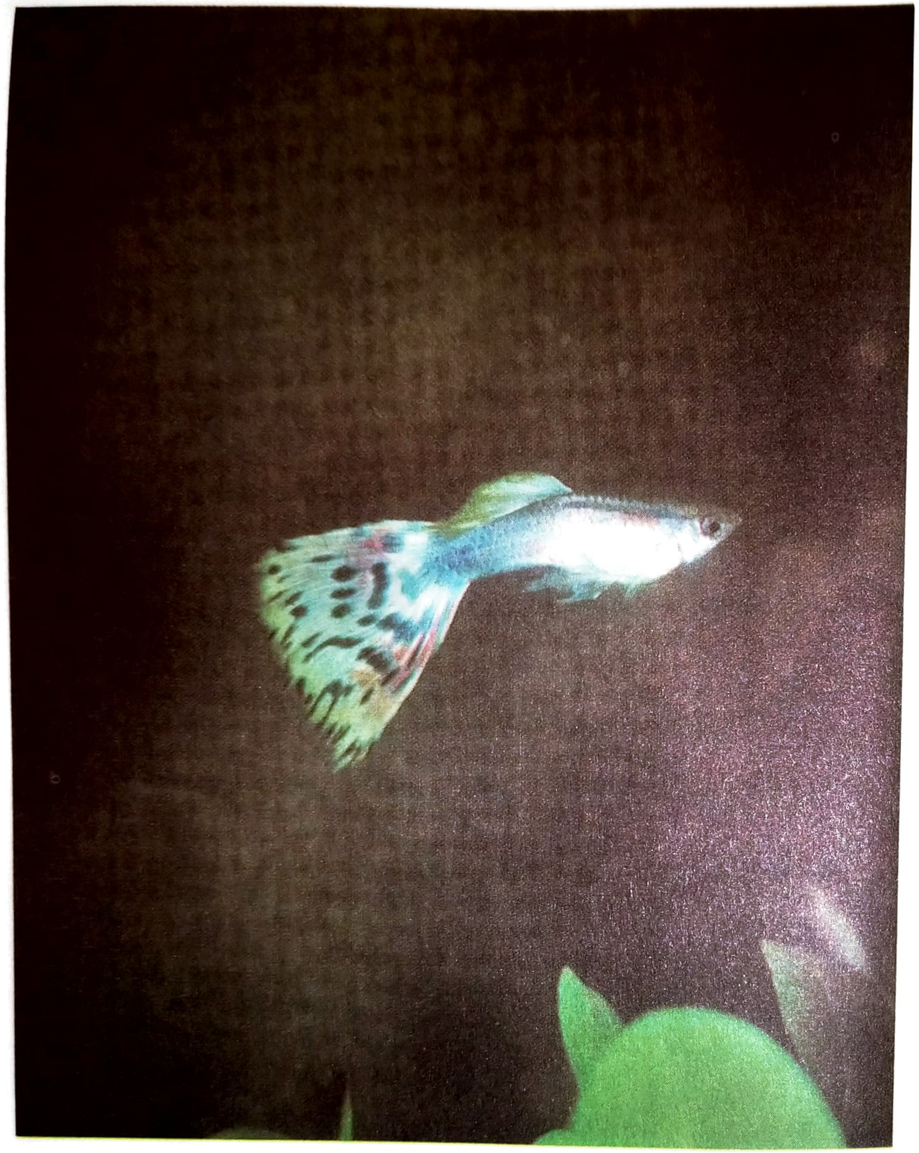
The authors recommend that you use foods that are both good for your guppies and appetizing to them. Axelrod's Formula and Miracle Tubiflakes are two such foods. Photos courtesy Miracle Plastics Co.

guppy in nature is eating more or less continuously and it cannot take in at one go enough food to last it for more than an hour or two. It can, therefore, only grow at a maximum rate and attain a maximum size if feeding is reasonably frequent. Larger fishes are able to gulp down sufficient food to last them for a longer period and so it is possible to cultivate fancy goldfish and various others, once they are past the fry stage, with less frequent feeding than is necessary for the successful rearing of fancy guppies. It goes without saying that with such a frequent feeding routine, care of the tank is more than ever necessary, because the danger of excess food polluting the water is a very real one. It is for this reason that filtration is almost universally advocated with the presence of activated charcoal so as to help to absorb any noxious products that may inadvertently be produced.

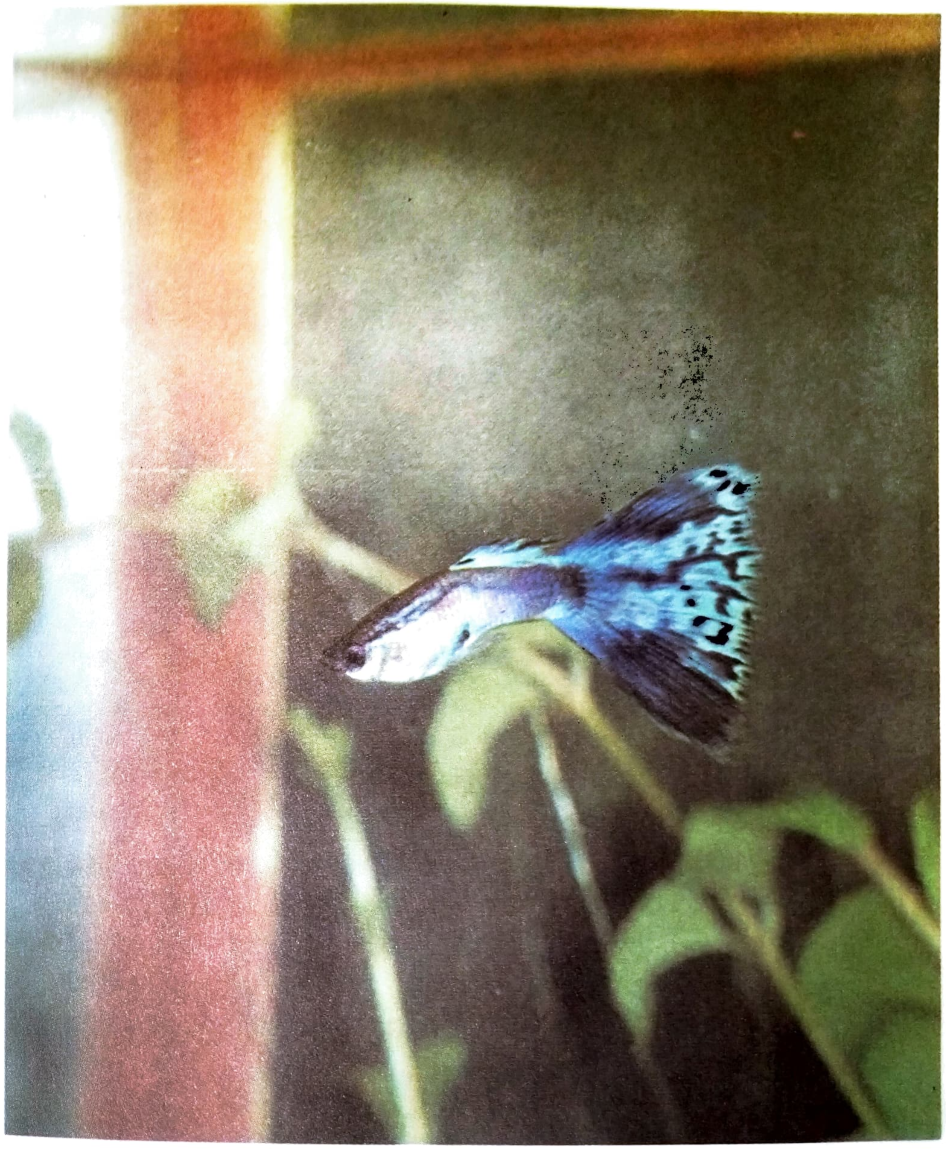
Young guppies should, of course, be fed just as frequently, but they cannot eat as big a variety of foods at first as can the adults. There are two important staple diets, newly hatched brine shrimp and micro-worms. Either of these, but preferably both, form a good basis for the diet of the guppy during its first month or two of life. Both can be taken by the newly born fry and will, if necessary, form an adequate first food for a period of several weeks at least. However, it is highly advisable to feed a variety of foods as early as possible so that the young fish do not depend upon a single type which may have some degree of deficiency and therefore impair their full development. Gordon has demonstrated the tremendous difference that early live feeding makes in the development of the guppy. Therefore, although it is feasible to raise guppies on finely ground dry food even from the beginning no thought to such a procedure would be given by the serious breeder, because the result would be very dwarfed fish compared with that attained with live food. Thus the new-born fry will be fed

Well-fed guppies will be large, robust and always on the move like this pair of snakeskins. Photo by R. Zukal.





A multicolor, pastel-shade, veil tail guppy. The blend of subtle colors in the tail of strains like this one appeals to a growing number of hobbyists. Photo by Hansen.



Single-color tails are preferred by many hobbyists. A number of breeders strive not only for single color, but also for absolute uniformity of the color's intensity. Photo by Hansen.

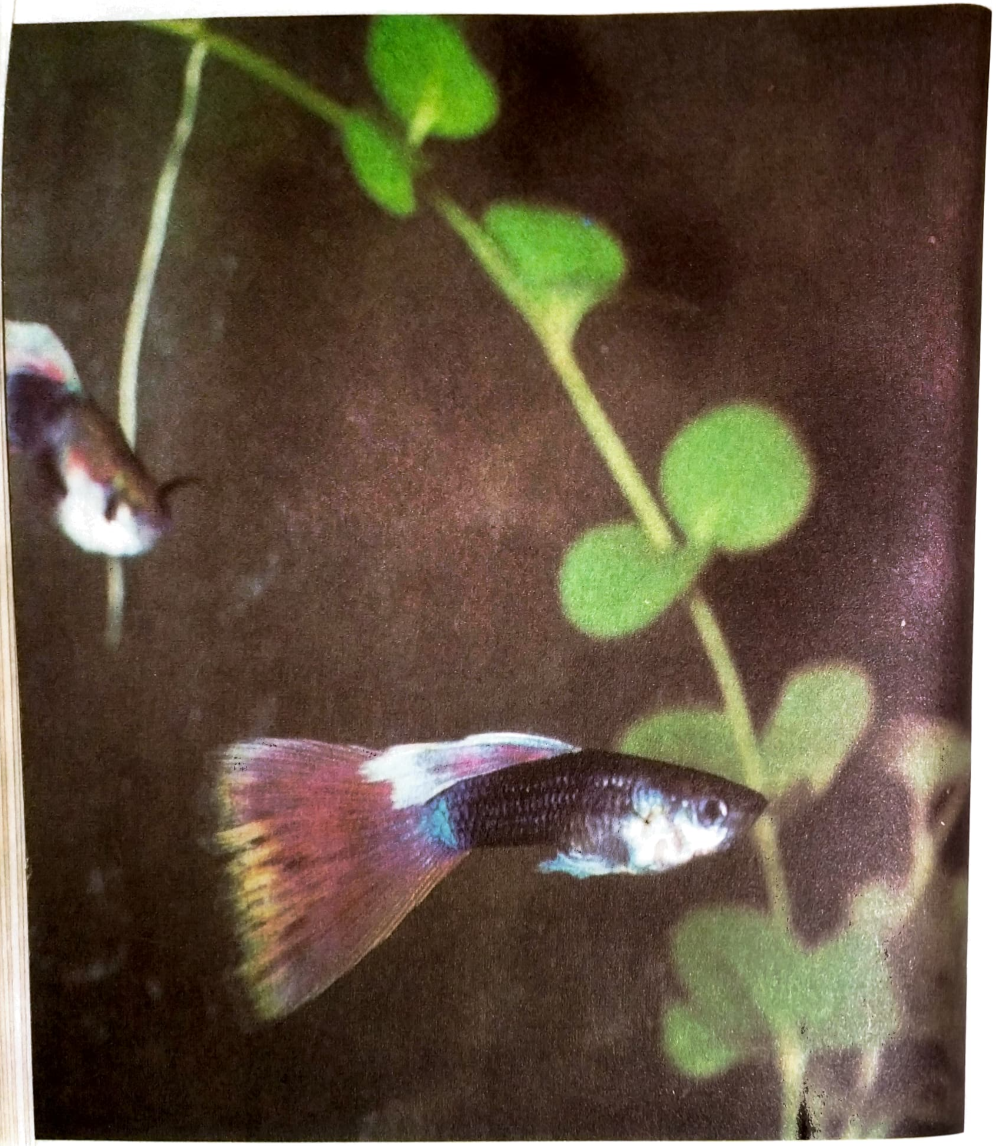
Once the sexes are placed together, the males immediately begin chasing the females. Be sure you use only your best males in the breeding tank; inferior males will fertilize females a greater percentage of the time than will fancy males if both types are present. Photo by R. Zukal.

newly hatched brine shrimp several times a day, perhaps alternating with micro-worms, and after the first week or so a little dried food, finely ground (but not dust), can with caution be introduced. Finely divided tubifex and sifted *Daphnia* and various other fine grades of live food can also be introduced and even substituted, if necessary, for the almost universal brine shrimp. When the sexes are separated (if they are) Kaufman recommends that the females be fed more frequently than the males, since they will be growing larger and should, presumably, need a total greater food intake.

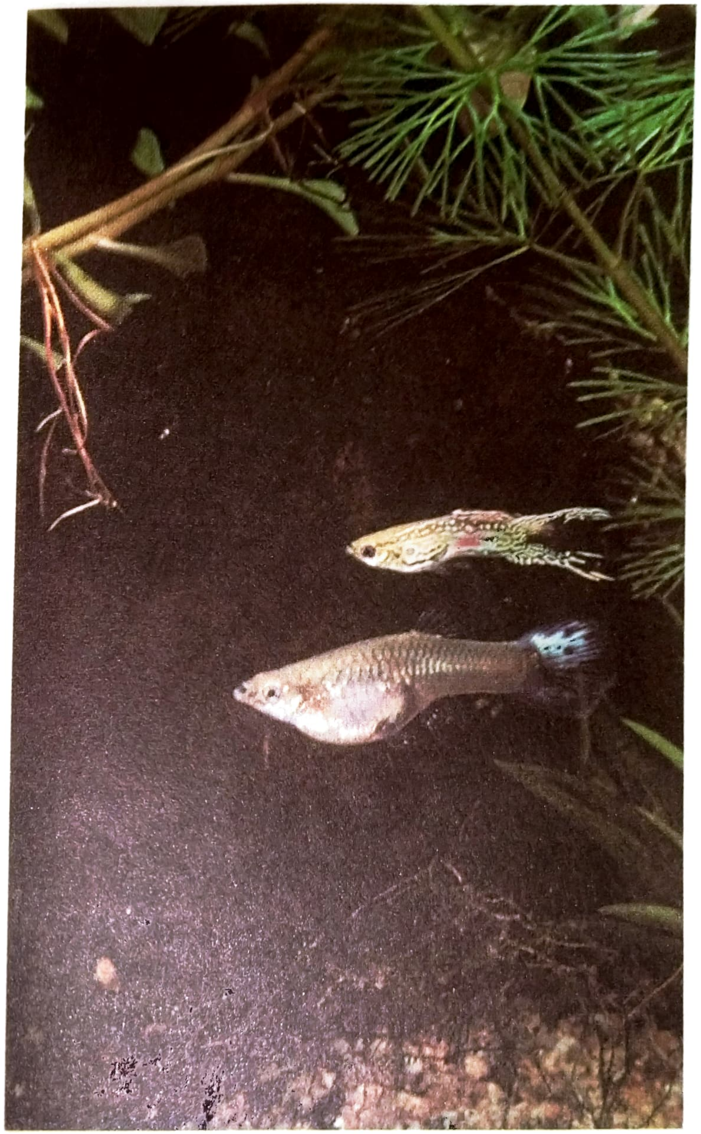
Some breeders concentrate on developing guppies with long dorsal fins like those of these fish. The dorsal fin does not begin to develop to any extent in such specimens until they reach an age of at least 7 months. Photo by R. Zukal.

Principles of Guppy Breeding

Mention of the feeding of fry brings us rather automatically to the question of the development and selection of the young guppy. For this reason we shall deal with it first rather than go into the more genetic side, which will include discussion of the selection of parents. A newly born batch of guppies is, of course, of mixed sex, but this cannot be told until the age of about four weeks is attained. Whether the young guppies are separated from their mother is in part a matter of choice and in part a question of her tendency to eat them. A variety of guppy traps is used and about the only



This ink-blue bodied guppy is a real beauty. The pink veil tail is a particularly good contrast to the body. Photo by Hansen.

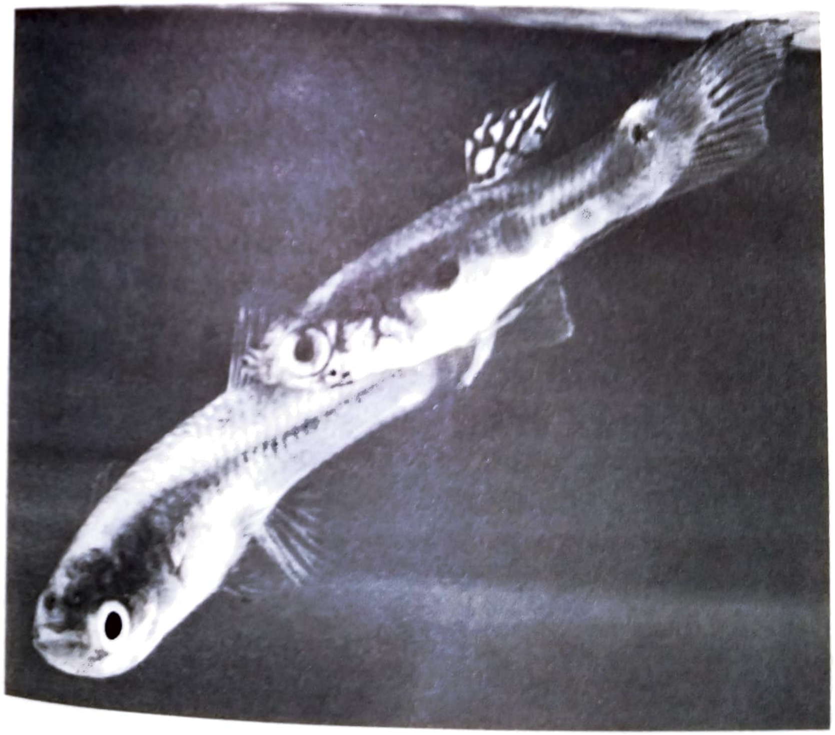


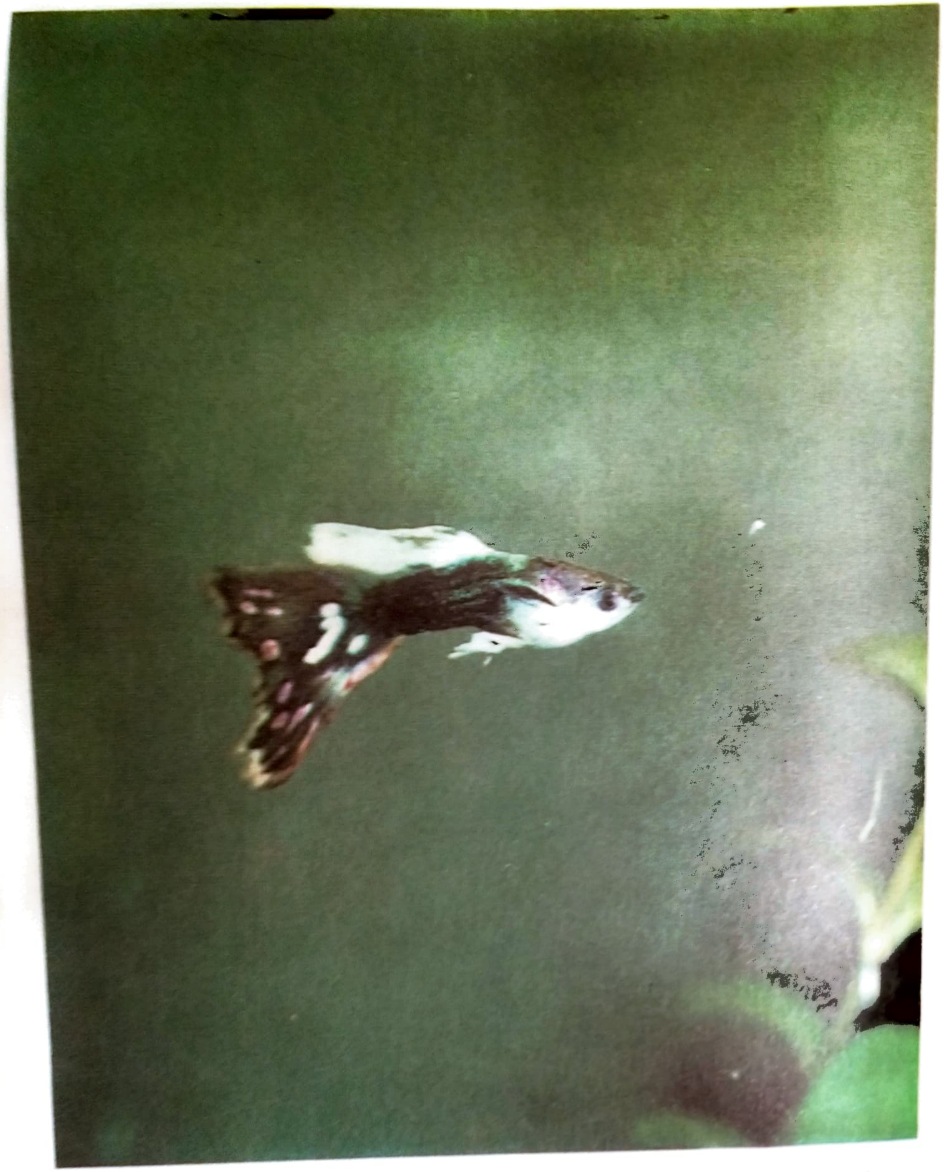
A pair of snakeskin guppies from Czechoslovakia. The touch of white with black spots on the female's tail is often found in snakeskins. Photo by R. Zukal.

An array of beautiful male guppies like these can really make an aquarium sparkle. All these fish were raised on a fish farm in Florida. Photo by Dr. Herbert R. Axelrod.

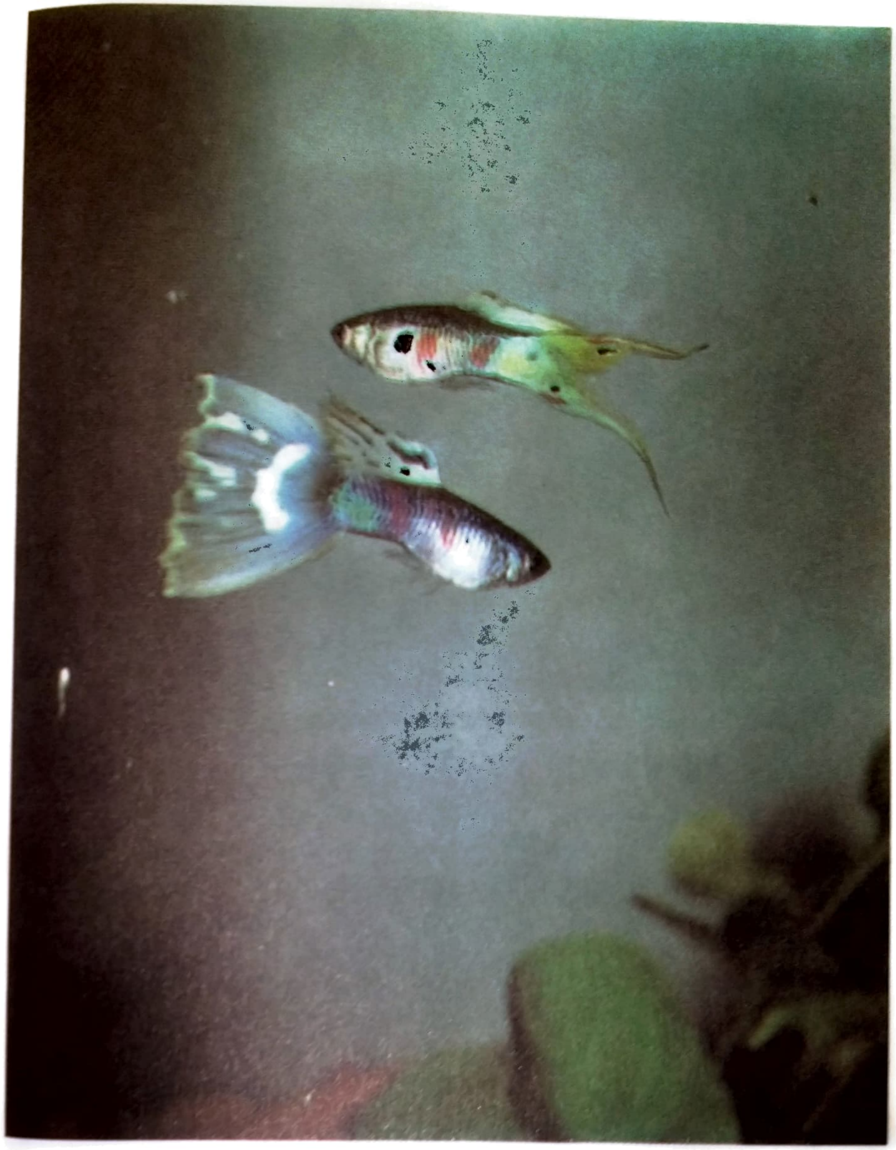
advice that can be given at this stage is that a large one be used so that the female is not unduly confined, if one be used at all. If the mother is well fed she will not eat her young, but if there is any danger of this occurring then it is most important that the young and the mother be separated immediately, as by a breeding trap, because she appears to be much more liable to eat the larger young first and thus make an immediate self selection against the very type of fish we wish to breed, the large ones. It is, therefore, important that all of the young be saved so that you do the selecting and not the mother. The young males and females can be separated from one another at about a month and prior to this stage will not have mated, although a more mature male in the same tank is believed to be capable of fertilizing even very young females. This should, therefore,

This unusual photo shows the male guppy moving in to attempt to fertilize the female. Note his rod-like gonopodium swung forward for action.





This three-quarter-black guppy is unusual in that the black body color is carried over throughout its veil tail. Photo by Hansen.



Two European guppies: left, a light blue veil tail—right, a split tail. Photo by Hansen.

Males and females can be put together at an age of 3 to 4 months. Photo by R. Zukal.

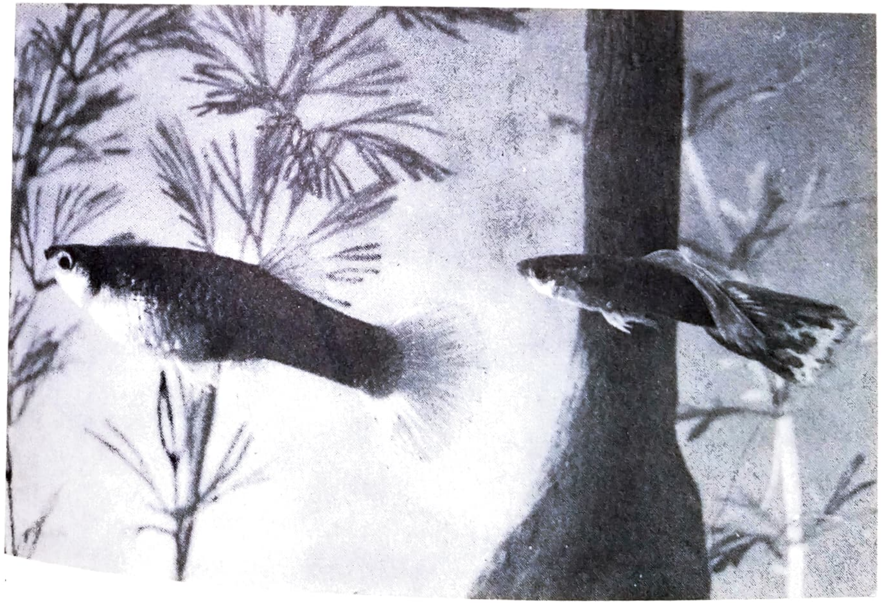
be avoided. The separated male and female fry should then be raised in groups to the age of 3–4 months to get as much size on them as possible and to prevent too early breeding.

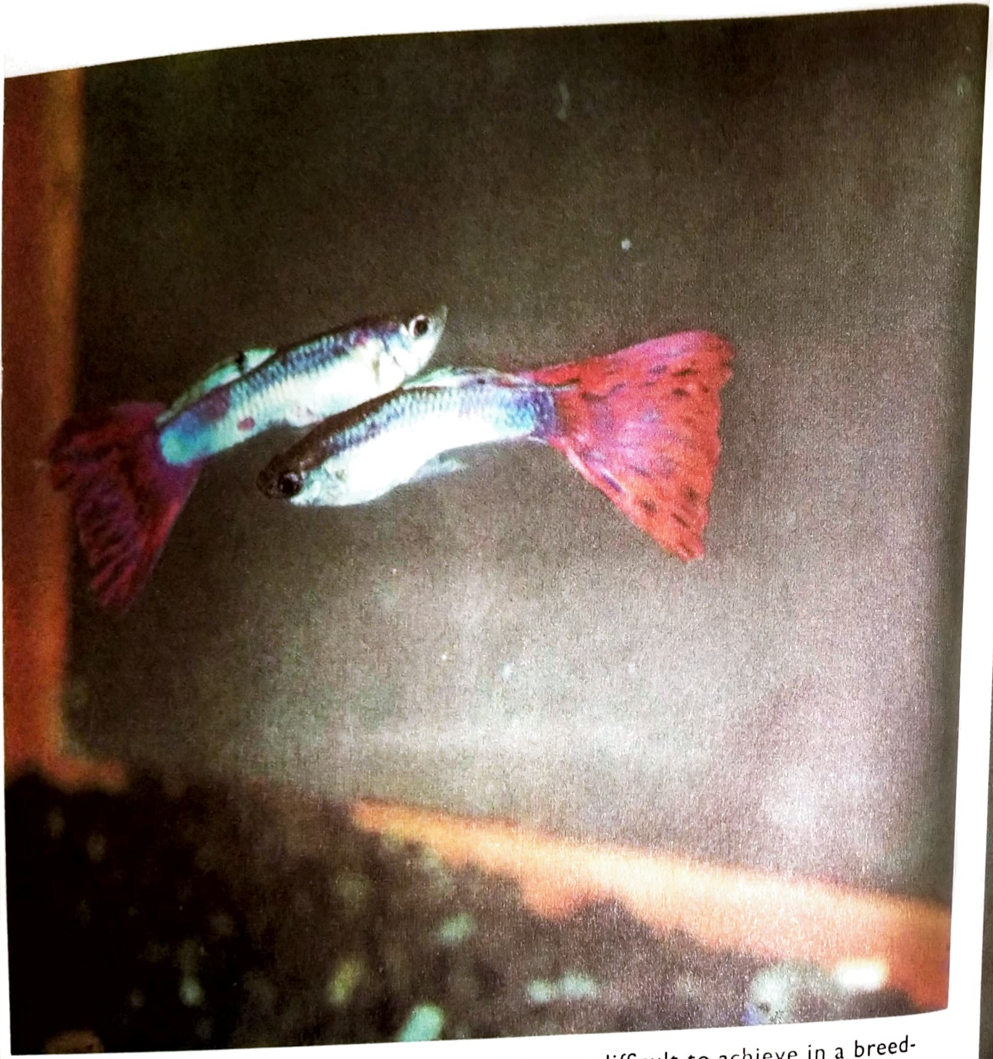
If one is breeding for fancy fish this procedure involves two most important principles. First, early breeding of females tends to slow down their growth and thus to reduce not only the size of the mother itself undesirably, but also to reduce the size and batch size of the young she may produce. Big mothers grow big babies. Secondly, even if it is desirable to mate small batches of guppies together rather than to try and raise them in pairs, it is not desirable to raise all of a batch of fry together because some degree of selection must be exerted. Even further, if a batch of males of variable development is left together with females, the smaller and

smaller-finned males are the quickest to mature and are liable to fertilize the females much more frequently than their larger and slower moving counterparts. This again will result in the reverse type of selection to that which is desired. Nevertheless, it is not desirable to try to raise individual pairs. These are hard to feed properly without water pollution and they do not seem to get on so well as when in the presence of several other pairs, which embodies a degree of competition in feeding and mating and also prevents too great a degree of inbreeding.

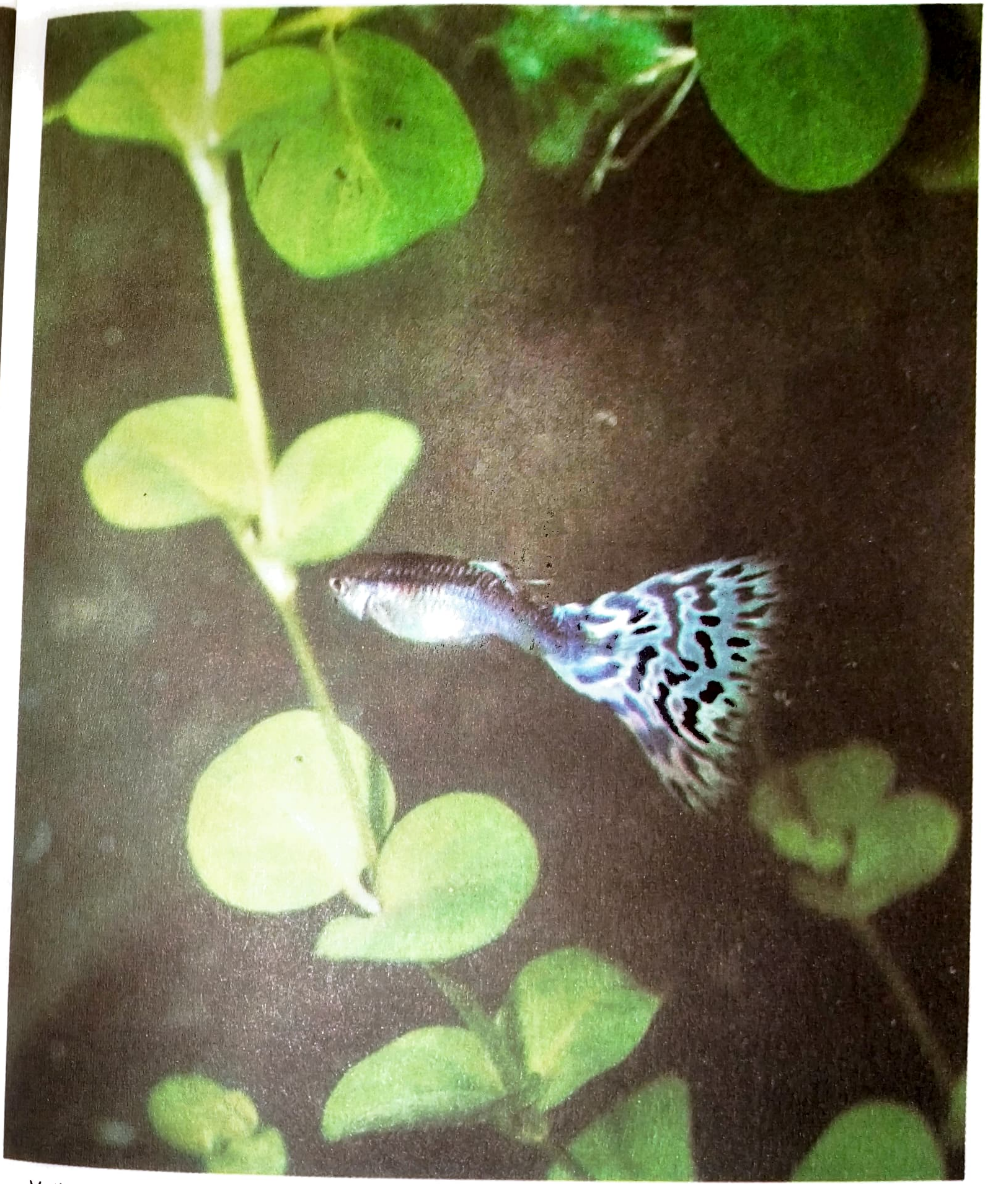
During the first few months, and varying somewhat from strain to strain, the guppy reveals its potential for body growth. Kaufman describes three stages in the development of the fancy guppy; body growth, which should attain about 70% of its eventual limit at four months and 100% at eight months; tail growth, which only starts at about the fourth month onwards and attains a maximum at about seven months; and finally growth of the dorsal fin, which occurs last of all during the approximate period 7–9 months. He recommends the age for show guppies as being, therefore,

The male of this pair has a scarf tail. The fully developed dorsal fin indicates that he is at least 7 months old. Photo by R. Zukal.





Uniformity of color and size in guppies is very difficult to achieve in a breeding program. It is a credit to the breeder of the males above that he has produced not only a very beautiful strain, but also a strain that produces males that are as close to identical to one another as it would seem to be possible. Photo by Hansen.

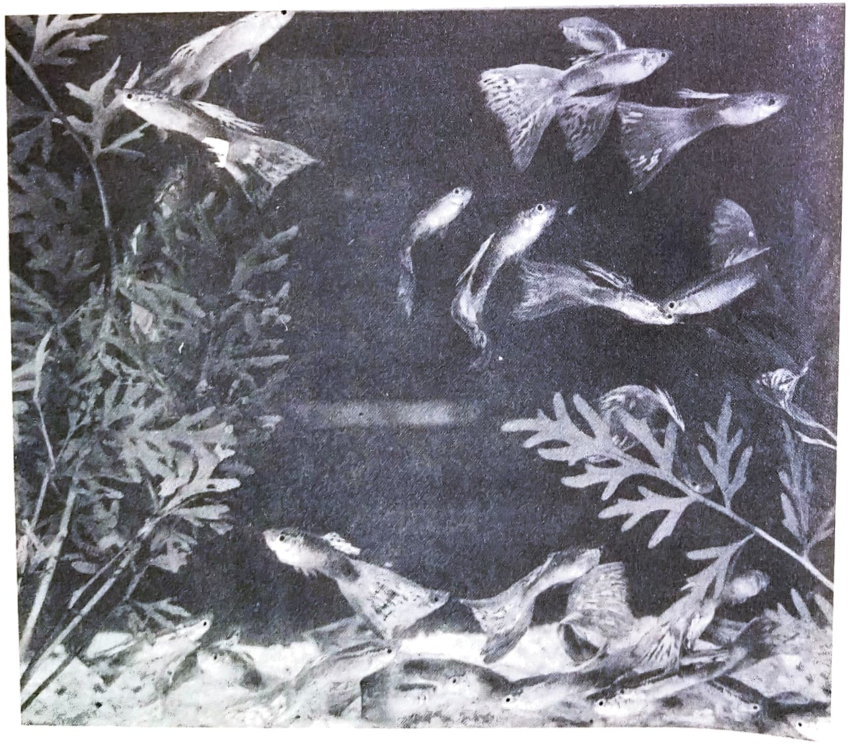


Veil tail guppy enthusiasts classify strains by the color of their tail. The fish above would be called simply a "blue." Photo by Hansen.

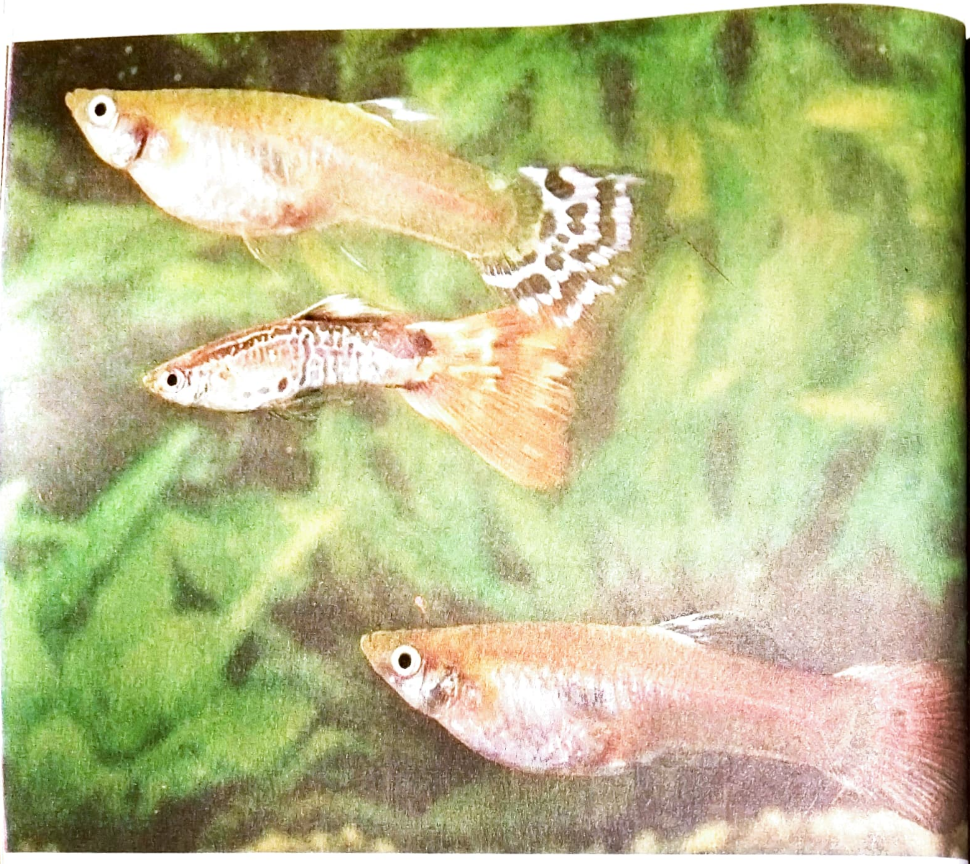
after the ninth month, but not long after, say within 12 months, at which period they should have attained as full a development as will ever occur. Growth in the females, limited, of course, by their lack of fancy finnage, follows much the same pattern, except that it will be fixed by pregnancy, after which they will only grow to about the same total extent, so that an early pregnancy will cause a dwarfing of the individual. Nevertheless, Kaufman recommends breeding of the female at about four months, because after this time she will decline in fertility.

There may be special problems in breeding particular types of guppy. As an example, we may take the rather extreme case of the albino. Albino guppies have some degree of popularity and are capable of developing into very nice fish, but the albino parents are not prolific and individuals are frequently sterile. Moreover, their physiology is such that albino young born of albino parents do not readily become first-class adults. Instead, the albino is best bred as the heterozygote—in other words, from colored parents. Albinism is recessive in the guppy, as in most animals, so that the gene for albinism may be carried by normally appearing fish and if this is present on both sides, or if an albino male is mated to a series of heterozygous females, it is possible to obtain well developed newly born young, one quarter or one half of which will themselves be albinos, in theory. In practice, the young carrying the albino gene do not compete readily even prior to birth against their normal brethren and so a lower proportion of albino fishes must be expected. If they are not separated as early as

Fancy male guppies make ideal inhabitants for a single-species tank. Photo by Dr. Herbert R. Axelrod.

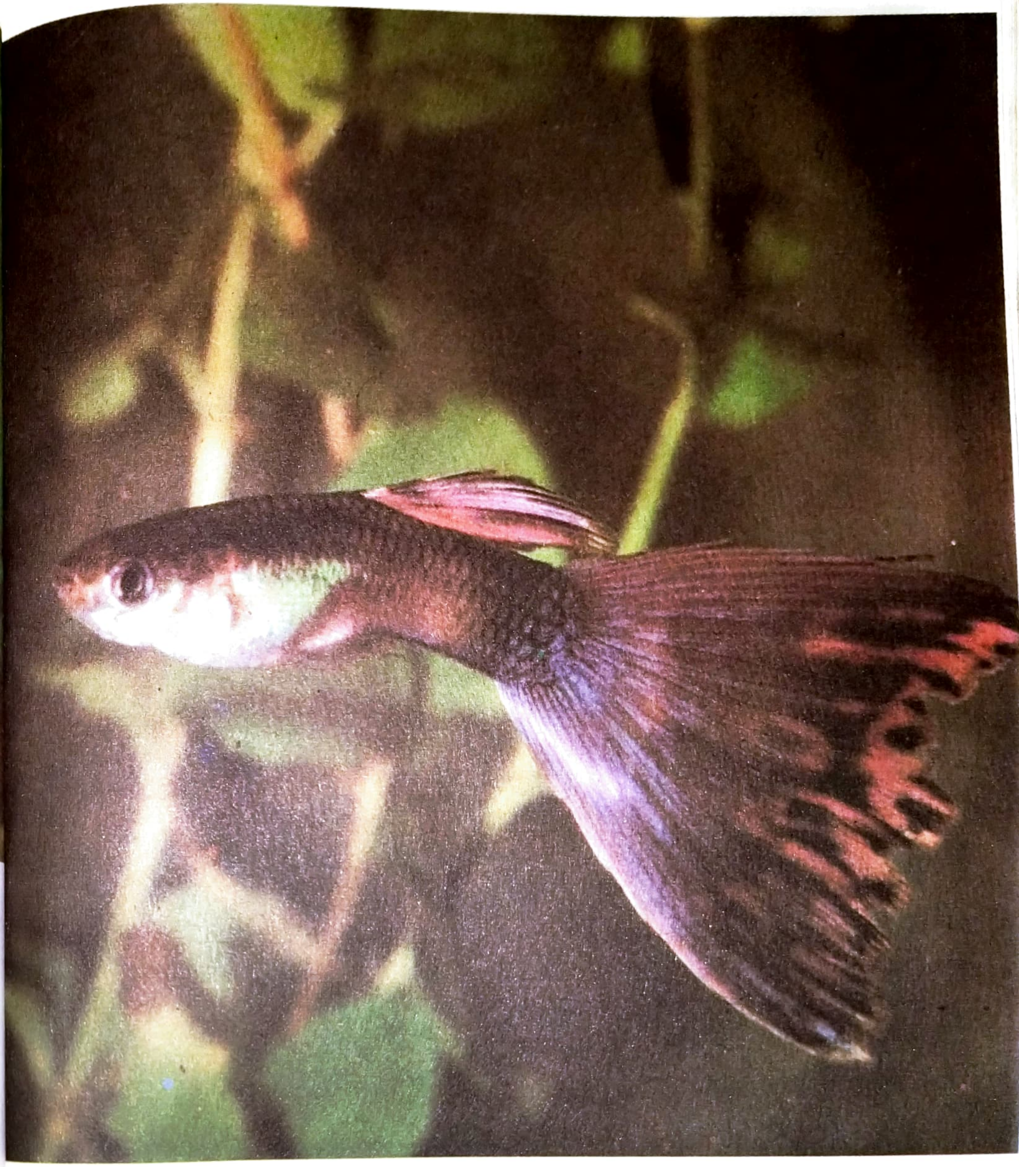


The enthusiast who really knows guppies looks not only at finnage and color, but also at body proportions. This male has good body weight. Photo by Dr. Herbert R. Axelrod.

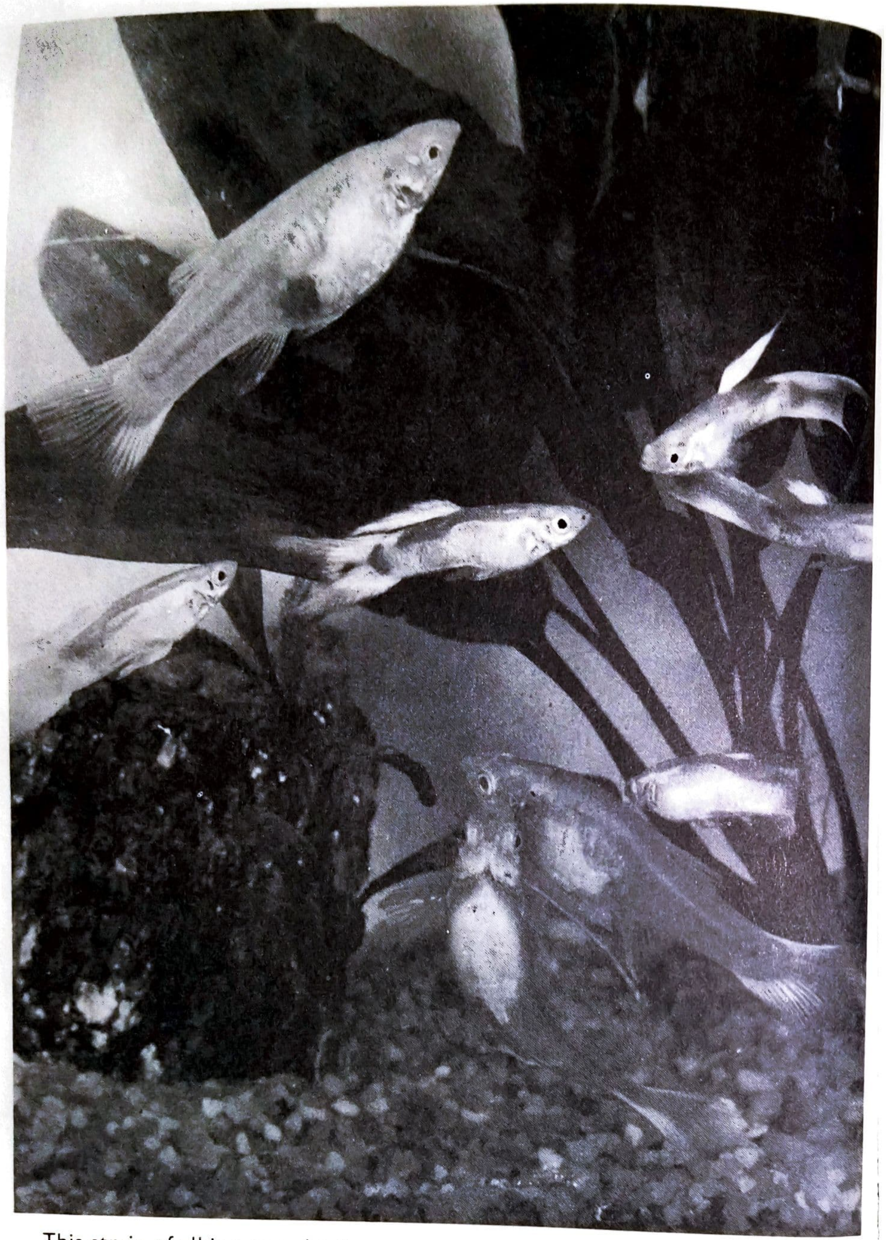


The first really good strain of snakeskin veil tail guppies was developed in the United States and named the King Cobra guppy by its breeders. When an albino turned up among the fry of one of these guppies, the breeders were quick to use it to develop an albino strain of King Cobras. The fish above are members of that strain. Photo by M. F. Roberts.

possible after birth competition will again reduce their rate of growth, if not their numbers, and so this particular type of fish can only be brought to full flower if given very special treatment. This kind of fish culture, in less extreme form, is often necessary with strains which do not have the vigor of the normal animal.



This fantastic veil tail was produced in Germany. Photo by Hansen.

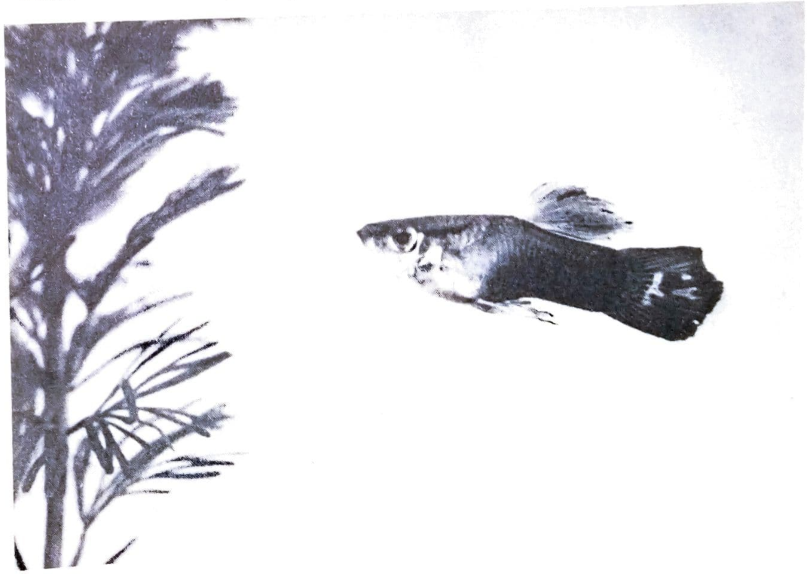


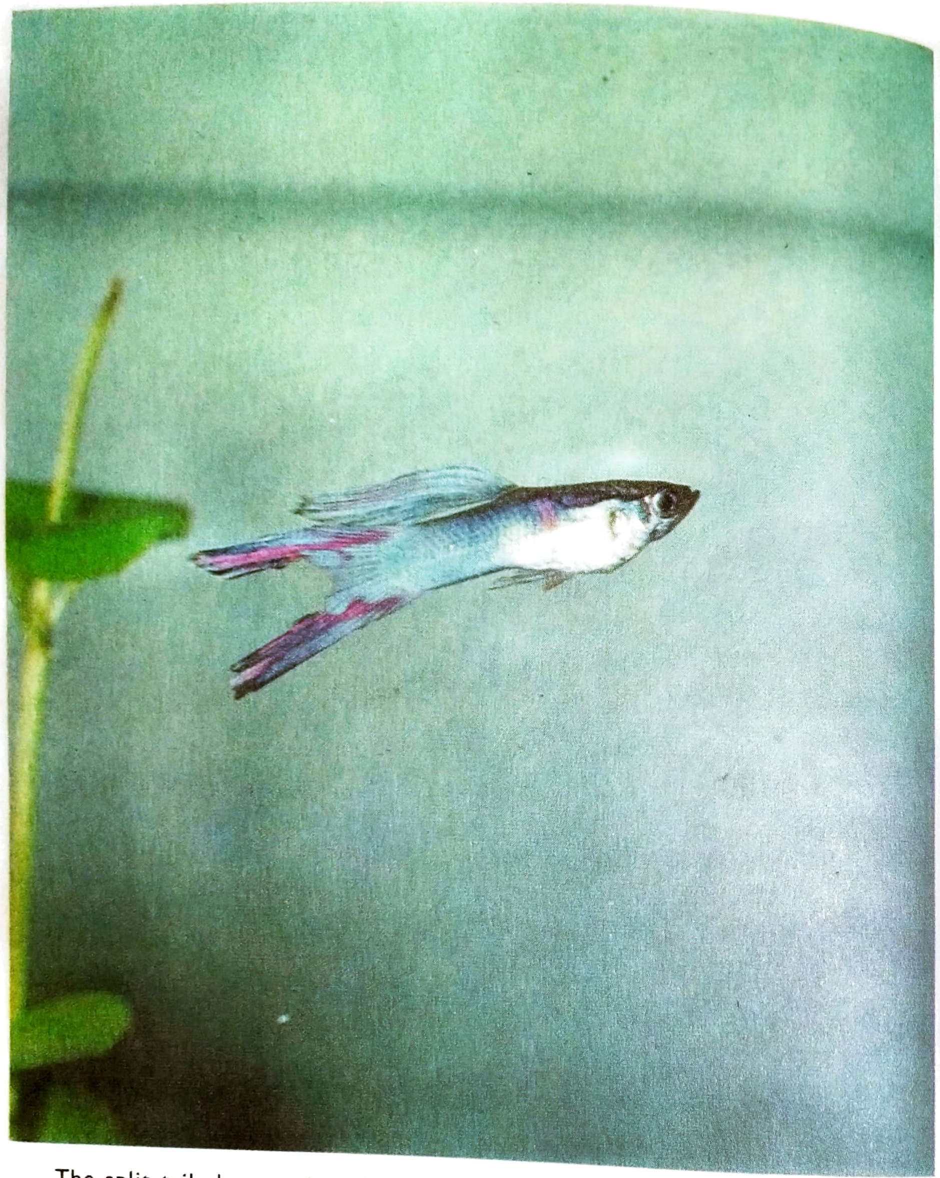
This strain of albino sword tail guppy was developed in the United States by Frank Alger. Photo by Dr. Herbert R. Axelrod.

Genetic Selection

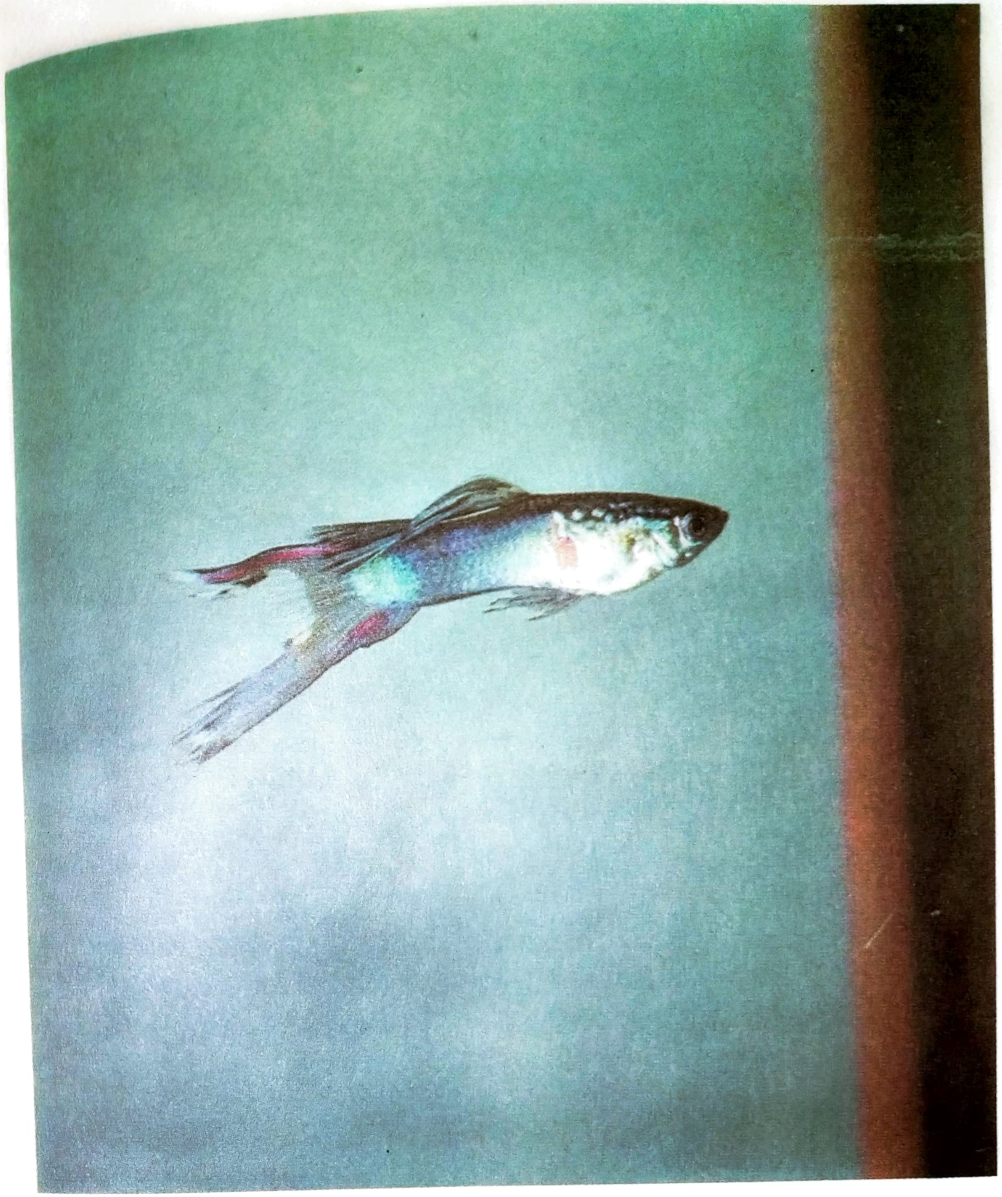
There are many ways of tackling the problem of breeding stable strains of attractive guppies, which with intense selection and care may be expected to be rated as first-class, even prize-winning stock. Much has been written about methods for inbreeding, but it is doubtful whether the ordinary fancier can expect to succeed if he practices straightout inbreeding as a genetic program. Inbreeding has many disadvantages which often lead to failure, unless a large number of parallel inbred lines are set up simultaneously. It is also difficult to select successfully for more than one, or at the most two, characters at a time in an inbreeding program; the more characters you try to select at once the less successful you are likely to be. Thus to start off with a good, but not exceptional, line of fish and try to inbreed for finnage, body size, color and, perhaps, deportment all at the same time is a very difficult task.

One of the longest-enduring color types among guppies is the three-quarter-black. This fish was photographed in Czechoslovakia. Photo by R. Zukal.

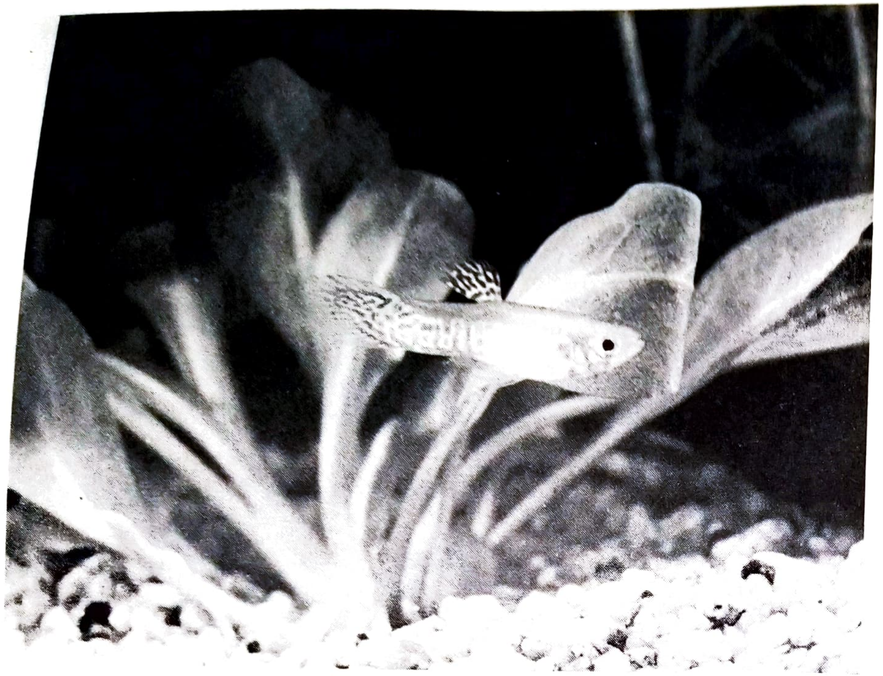




The split tail characteristic has been known in bettas, *Betta splendens*, for a long time. It is only recently that work has begun in creating attractive split tail guppies. Photo by Hansen.



One of the difficulties with split tail guppies is that the split rarely creates even edges. The result is a tail that seems to have been eaten away by fungus. Close examination, however, shows no sign of disease. Photo by Hansen.



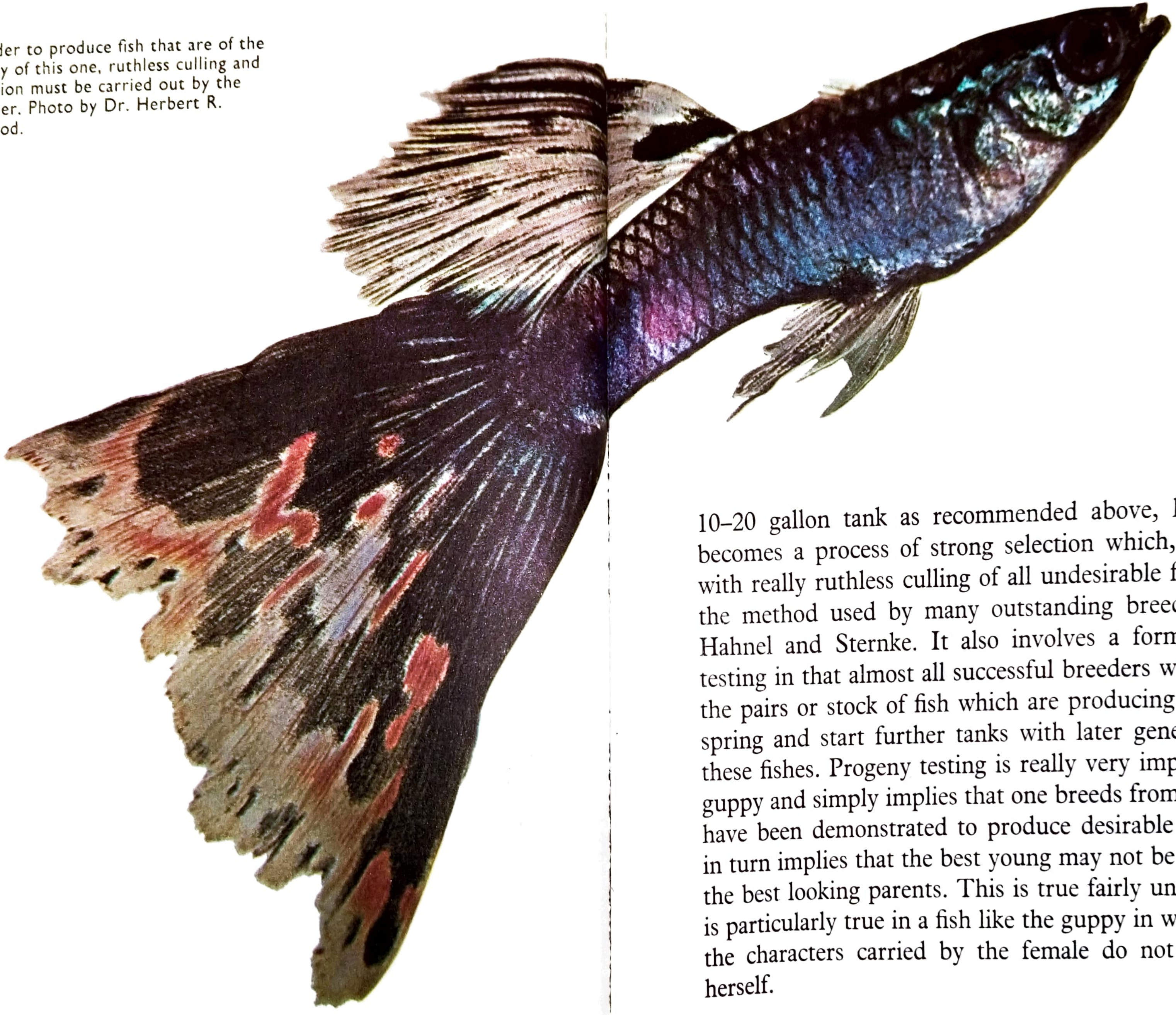
A typical snakeskin guppy. Note that the snake-like markings are present in the caudal and dorsal fins as well as on the body. Photo by R. Zukal.

There are various degrees of inbreeding, however, the extreme being serial brother-sister matings, sometimes parent-offspring matings, and it is this extreme which is likely to lead to a good deal of wasted time. Of perhaps half a dozen inbred lines started off, each of which will demand the use of a number of tanks or it will fade out, only one may prove useful and all the rest of the work is wasted. It would be possible to envisage a guppy production program along the lines used in corn breeding or poultry breeding by the big producers—the use of F_1 crosses (first generation crosses) of two inbred lines to produce vigorous uniform offspring. The further offspring of such crosses are unlikely to be of any use; instead the F_2 (second generation) will be variable and for the most part useless. It is, however, perfectly feasible to envisage a program of establishing two or more pure bred lines, none of which may be in itself outstanding, but the first cross of which could be prize winning fishes.

Line breeding is a rather diluted type of inbreeding, which has not really been very thoroughly defined, but which in essence means the selection of a few pairs of fish from good looking parents and the selection of the best of their offspring for further breeding, with a repetition of the same crosses. It implies much less inbreeding and, therefore, less chance of degeneration of the stock, with a moderate chance of steady improvement. When extended somewhat to the keeping of a number of pairs of guppies in the same

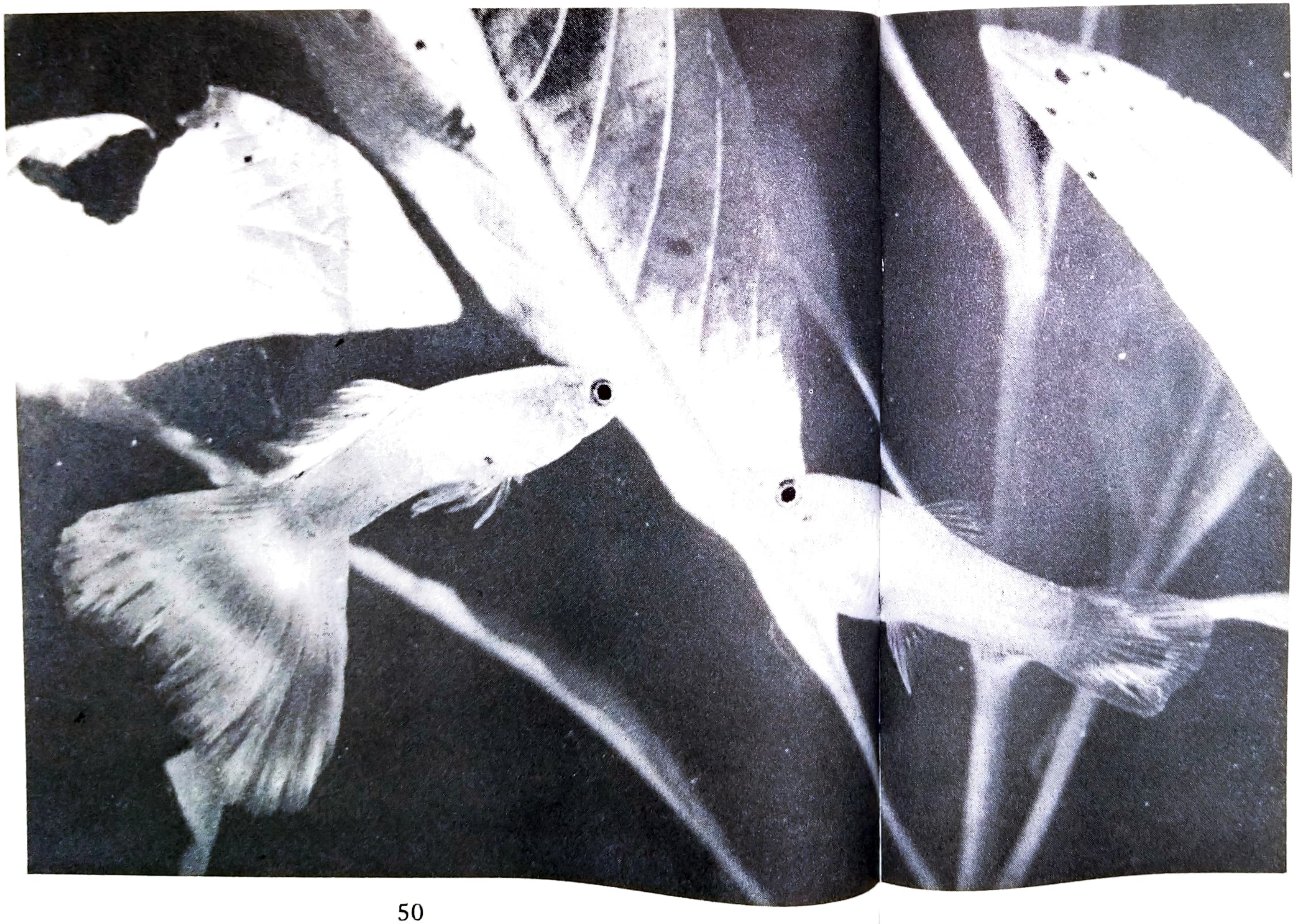
The proper kind of breeding program will make possible the continued production of relatively uniform fancy guppies. Photo by Dr. Herbert R. Axelrod.

In order to produce fish that are of the quality of this one, ruthless culling and selection must be carried out by the breeder. Photo by Dr. Herbert R. Axelrod.

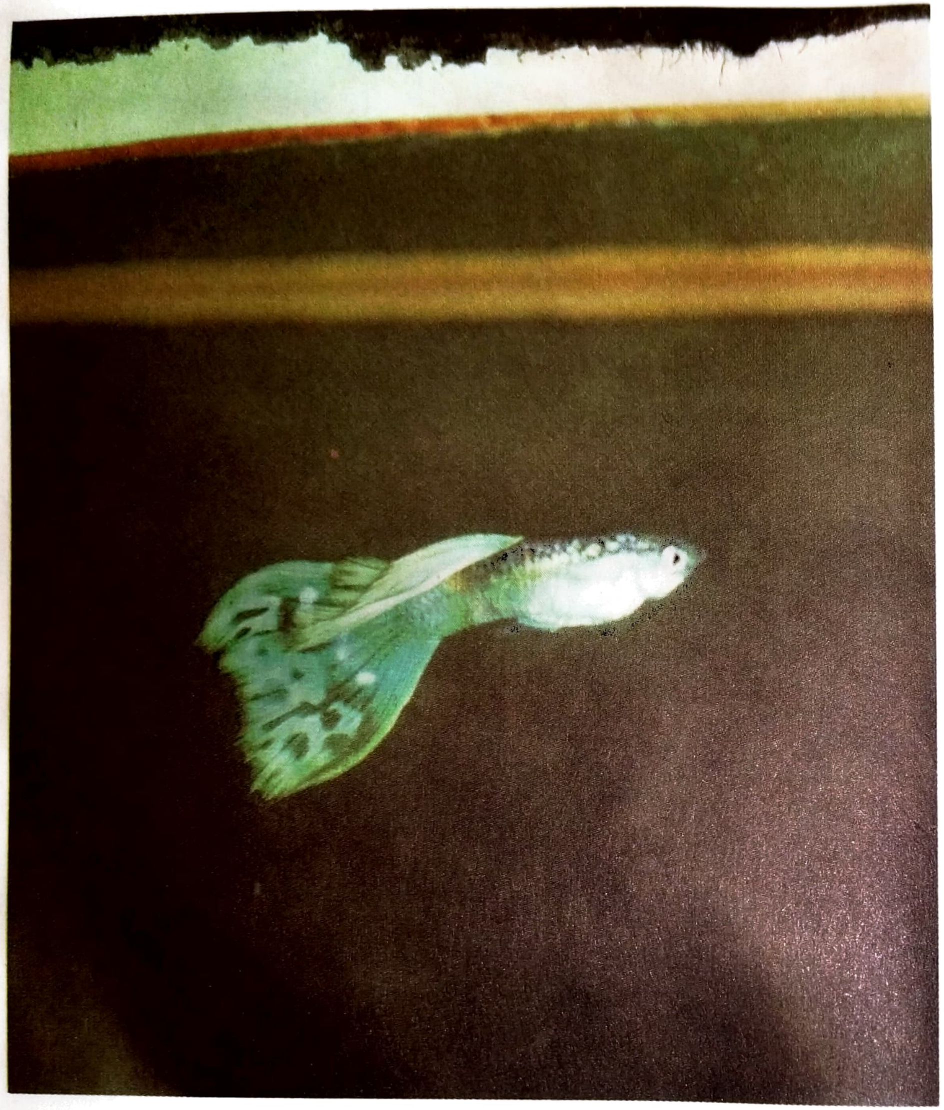


10–20 gallon tank as recommended above, line breeding becomes a process of strong selection which, if combined with really ruthless culling of all undesirable fish, is in fact the method used by many outstanding breeders, such as Hahnel and Sternke. It also involves a form of progeny testing in that almost all successful breeders will go back to the pairs or stock of fish which are producing the best offspring and start further tanks with later generations from these fishes. Progeny testing is really very important in the guppy and simply implies that one breeds from parents who have been demonstrated to produce desirable young. This in turn implies that the best young may not be produced by the best looking parents. This is true fairly universally, but is particularly true in a fish like the guppy in which some of the characters carried by the female do not show up in herself.

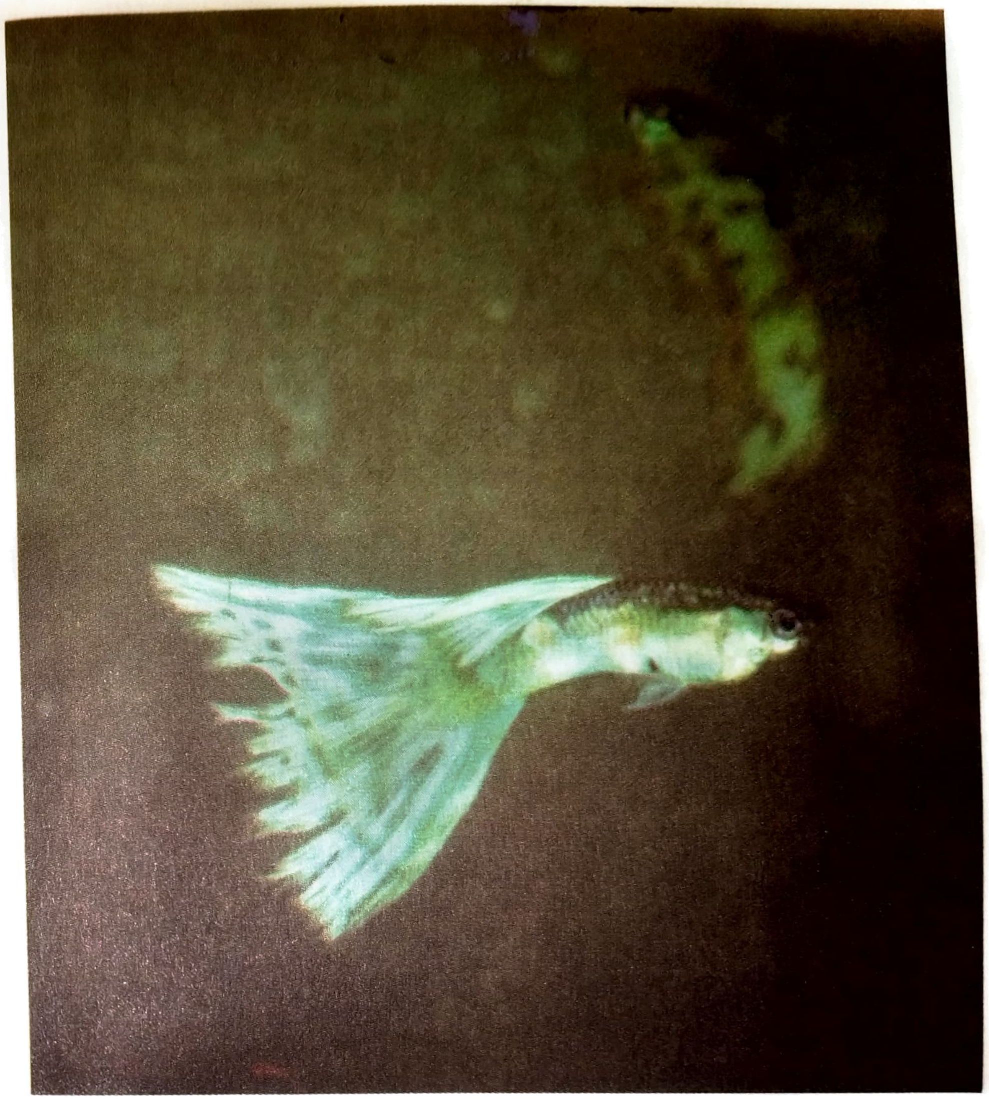
One can see how any of these types of breeding requires a considerable amount of room and tank space for a successful outcome. A breeder with limited space must clearly confine himself to a limited program, such as the perfection of one single type of guppy. If a start is made with stock from a reputable source in which the young are guaranteed to be the offspring of the strain concerned, then continued strong selection and care of technique and stock along the lines indicated earlier should continue to produce better and better fish with each generation. Naturally, whether one eventually produces an outstanding prize winner must



Top—These are two American-bred, double-sword guppies. Note the good, thick bodies on these fellows. Such bodies indicate proper feeding from the time the fish were fry. Photo by M. F. Roberts. Left—You may not be able to see the color of the male's veil tail, but you sure can see its luster. It looks almost metallic. Note that the female has a touch of the same luster in the color in her tail. Photo by R. Zukal.



Most novices are not observant enough to notice that there are variations in the shape as well as the size of the tails of veil tail guppies. This specimen has an unusually well rounded tail. There is a chance that the tail may "fan out" more. Photo by Hansen.

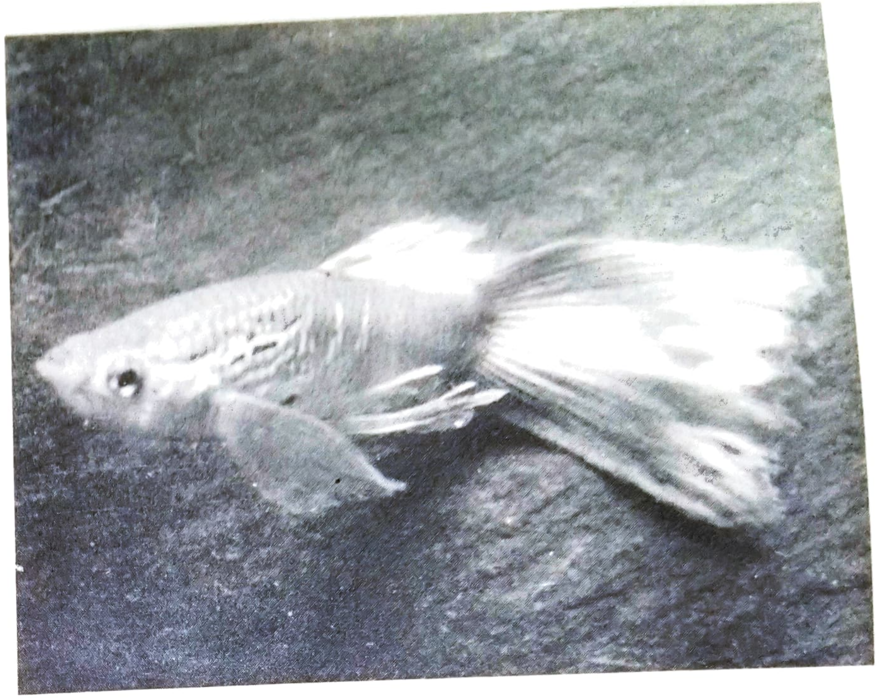


Look at the size of this fellow's tail. It is both unusually long and unusually wide. There is no doubt that this fish is a winner at almost any guppy show. His biggest fault is the ragged back edge of his tail. Photo by Hansen.

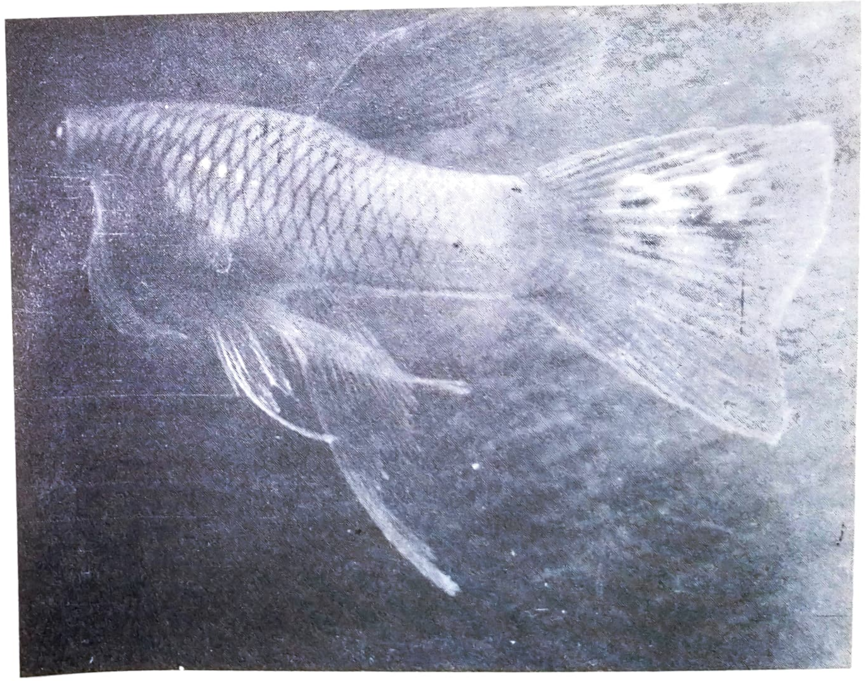
essentially depend, in addition to all other things, on the genes available in the parental stock to begin with and a gamble must be taken on this.

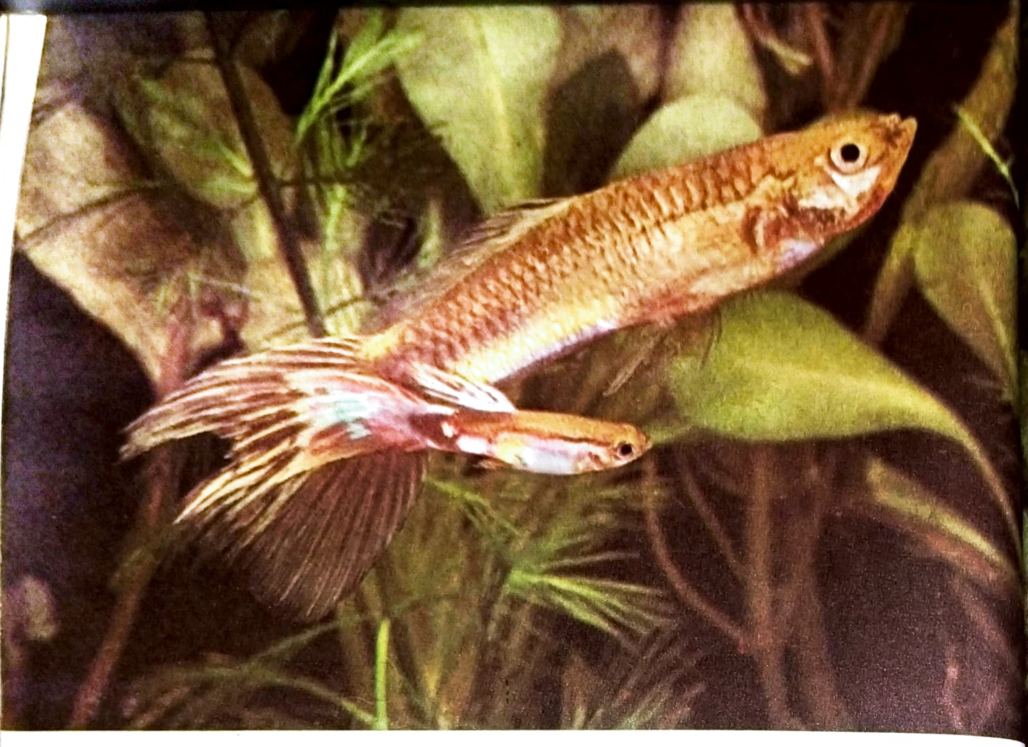
If selection pressure is eased on any strain of guppies it will rapidly degenerate back to something approaching the wild type. Even strains which have been bred to a stage where they throw as high as 90% good looking young, will revert in this fashion if care is not taken. Some of the reasons for this have been given above, such as the readiness of small runt males to fertilize the females much quicker than the slower moving, larger and heavier finned types. The general tendency for any stock is to revert gradually to the wild type unless in a situation where selection pressure is exerted to keep it moving genetically along some predetermined line. Even a good stock in which selection is continued will also degenerate unless optimum husbandry is practiced, again as indicated above. Thus the best Hahnel guppies put into a tank to breed at random and left for a few generations would horrify their producer if he saw them again.

We shall not enter here into any extended attempt to deal with the genetics of fancy guppies, partly because these have not been investigated with the thoroughness that one might imagine and partly because a detailed knowledge of the genes involved would not usually very much change the general advice given above. All kinds of ingenious breeding and cross-breeding experiments are necessary to establish the nature and number of genes affecting a particular character, and the shape, size and coloration of, say, the tail of a guppy will usually be determined by many simultaneous genes. Thus the building up of a strain by the combination of all the desirable genes necessary to contribute to success would be an enormous project far beyond the expectation of any ordinary fancier. Instead, he should use the general principles as already outlined.



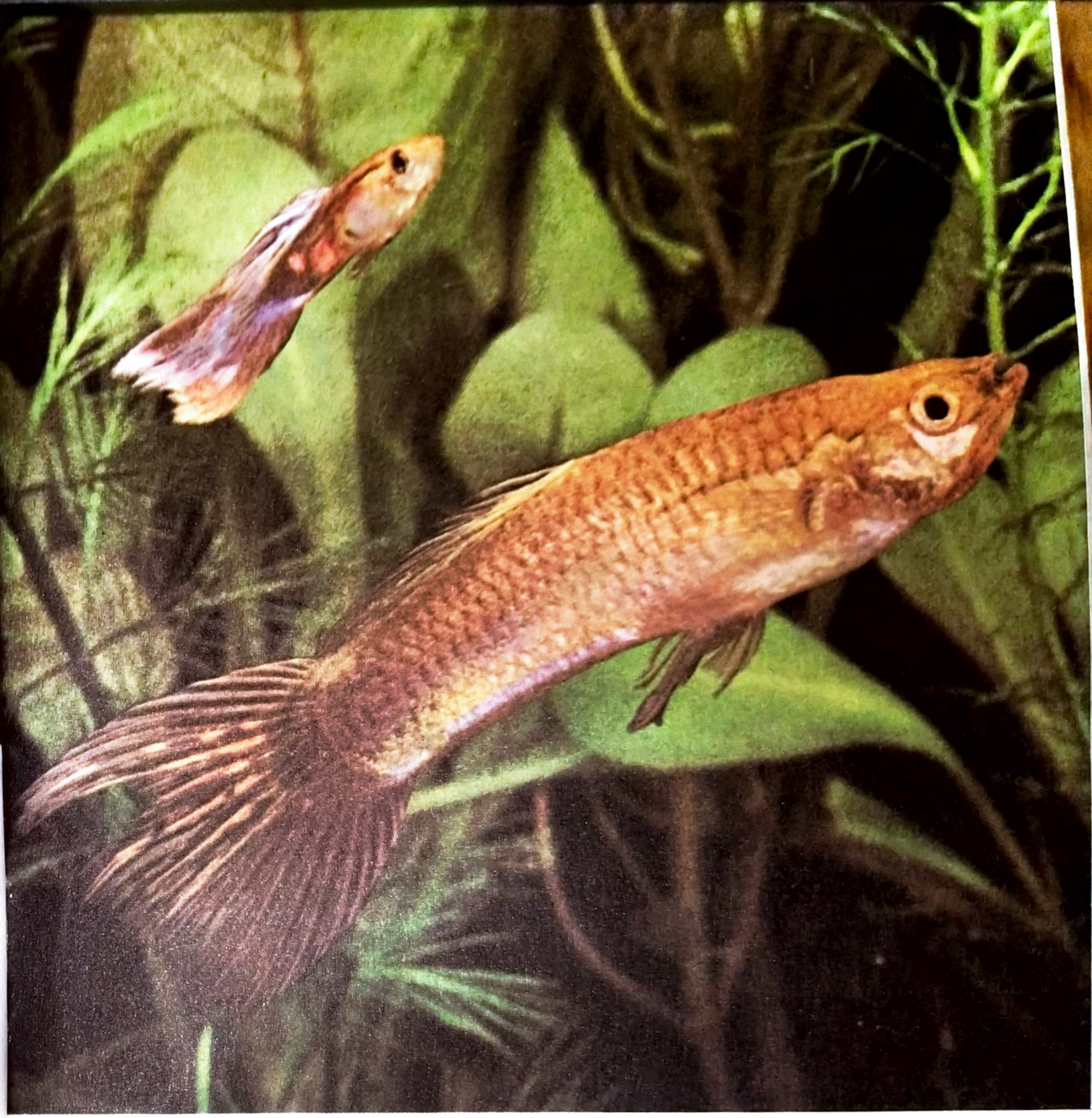
A male (above) and female (below) of one of the latest strains of fancy guppies. Both sexes exhibit large ventral and pectoral fins, something not previously seen in fancy guppies. In addition, the dorsal of the female is longer than that of many prize-winning males. The strain was developed in Germany.





Color Testing

There is one additional technique which should be mentioned, the use of male hormone to test the hidden coloration of a female. Colors in guppies are normally sex-limited, whether or not they are sex-linked, which means that the female does not show much color, except in one or two isolated strains. It is possible, however, to learn something of the colors she is capable of passing on to her male offspring by dosing her with small amounts of male hormone so that the color she carries starts to show up. If used in proper concentration the effect of the male hormone dies off when it ceases to be administered and the female's fertility is not affected. If too much is given the female may be spoiled for breeding.



Color testing females must be carried out with the utmost care. A hormone overdose given to the female pictured to the left and above resulted not only in her showing the colors she carried, but also in her developing a false gonopodium and a fantastic spurt in growth. This female will never be normal again. Photos by R. Zukal.

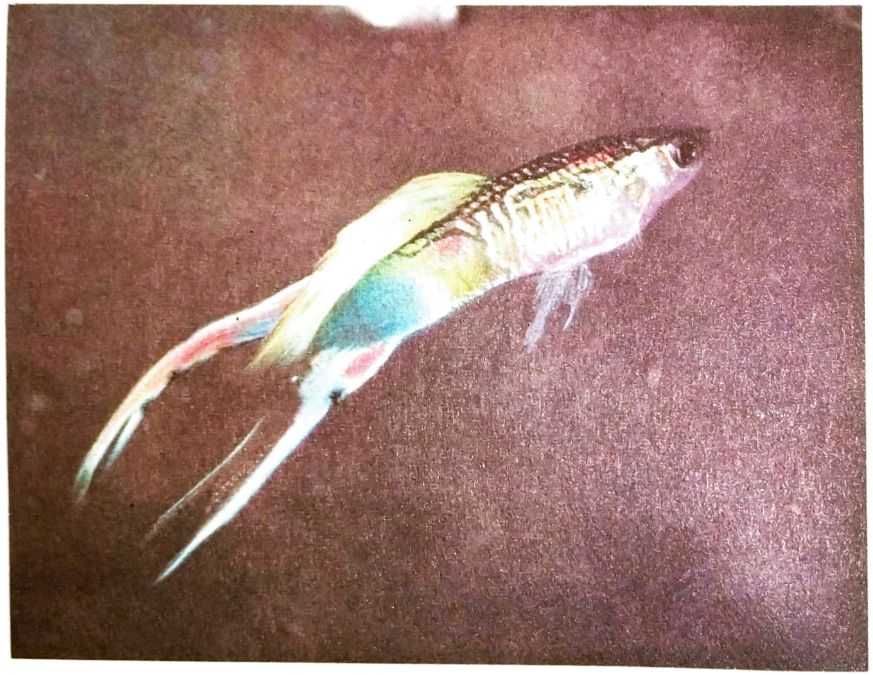
The most useful hormone is methyl testosterone, which should be made up at approximately 3μg/liter of water. Gordon, in the T.F.H. booklet "*Guppies as Pets*", gives a method for making this stock solution. For use, two drops of the stock solution at 3μg/liter are added to each gallon of aquarium water in which the female guppies are to be treated. Two further drops per gallon should be added every other day to make up for deterioration of the very dilute hormone solution. Half-grown females will show sufficient coloration in 2–4 weeks of treatment, but adult females may require up to 6 or more weeks to bring out their colors. Treatment should not continue for longer than this period or sterility may result, and treated females should be rested for 4 or more weeks after cessation of treatment to allow them to recover for breeding.

Strains of Guppies

The older breeders described many types of so-called fancy guppy, which we would not look at a second time today. They had the beginnings of present day long, flowing veil tails and very wide delta tails, but these were very puny compared with present day stocks. They also had a great variety of so-called sword tail, cofer tail, pin tail and other varieties of fancy males. Particularly in Europe, show standards were created which gave sometimes rather painstaking details of the exact shapes of tail, fin or body to breed for, and since these show standards unfortunately did not indicate that intense coloration was also desirable, it was possible to produce pale, almost colorless guppies which conformed to the standard as far as it was written down.

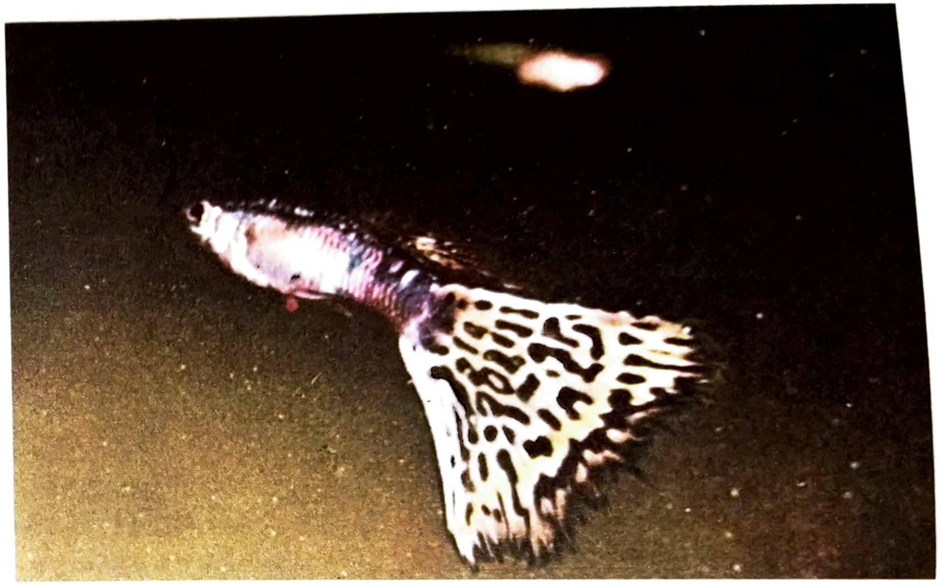
In great contrast to all of this, present day emphasis is upon long flowing tails and finnage with intense coloration in both fins and body, combined with a large sized fish. Size, as long as it is accompanied by good color and finnage, is very important as far as the general public and show judges are concerned. Even beautifully colored smaller specimens are liable to be discarded in favor of less colorful, but decidedly larger individuals. In the Summer, 1957, TROPICAL FISH HOBBYIST magazine, standards were published for showing and judging of guppies, and this was one of the heralds of the present day, particularly American, development of the fancy guppy. It still included the classification into round tails, spear tails, cofer tails, etc., together with colored varieties of veil tails, blues, reds, greens, blacks and variegated. It laid down the point table for all varieties of guppies, both male and female, with 20 points each for the body, caudal fin, dorsal fin, condition and deportment and color. It is not clear to what extent this type of standard has been used by outstanding breeders in selecting their various strains of fish. In the October, 1962, issue of T.F.H. magazine we find the corresponding German guppy standards, as described by Dr. Owen Stoezbach. They give a total point score of 20 to the body, 30 to the dorsal fin, 40 to the caudal fin and 10 for behavior and fin carriage. It is our impression that later American tendencies have been towards this German type of judging rather than otherwise, since massive caudal fin development certainly enters strongly into the present day breeds. Within the points awarded for body and finnage, 10 points would be awarded for color in the body, 10 for color in the dorsal fin and 15 for color in the caudal fin, so that a total of 35 points for color, as against 20 on the American scheme, would also be available. The German standards also go into very considerable illustrated detail of approved and non-approved forms.

No doubt, therefore, with these kind of requirements at least at the back of their minds, the main American and continental breeders have gone to work during the past decade in producing their strains. There has, however, been no extensive review of the available guppy breeds brought to the notice of the authors since one by Dr. Eduard Schmidt in the June, 1960, issue of T.F.H. By this time, however, the main American trend of guppy strains had been established, and, apart from a general improvement, there have been few striking innovations. The following account is, therefore, largely taken from Dr. Schmidt's article.

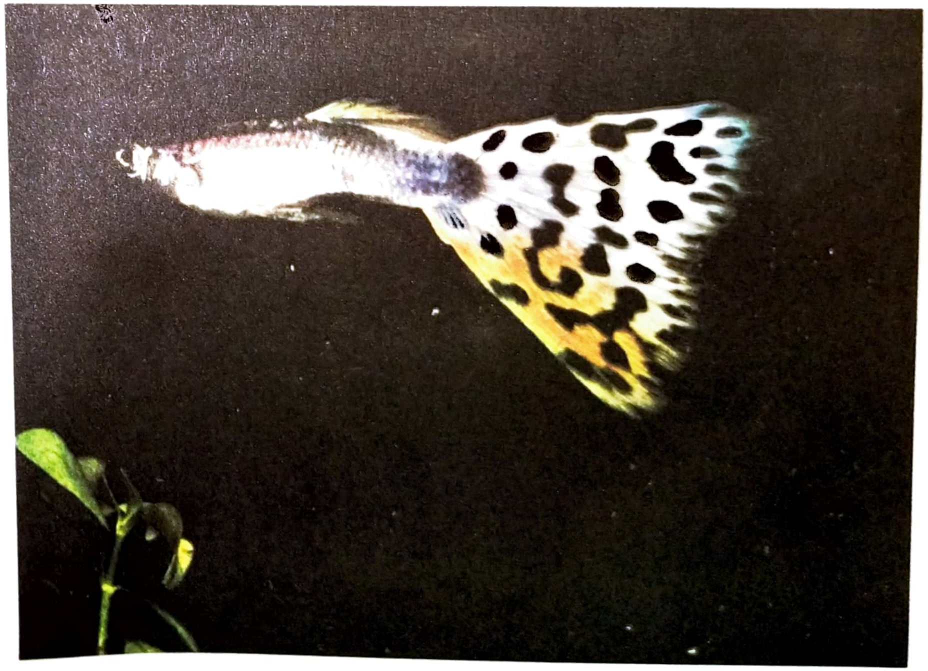


This double-sword guppy shows unusually good color. Note particularly the yellow tone in the well developed dorsal fin. Photo by Hansen.

The most popular English breed has for some time been the double sword guppy, in which both the top and bottom sword is well developed but the center of the tail does not fill out to create a complete delta tail or fantail. Bottom sword guppies are also popular with English breeders and some quite beautiful fish have been produced. Somewhat related to these, the rather beautiful continental emerald



It is only in recent years that German veil tail guppies have begun to rival those bred in the United States. These leopard-tail deltas represent what German breeders can do now. Photos by Dr. E. Schmidt.



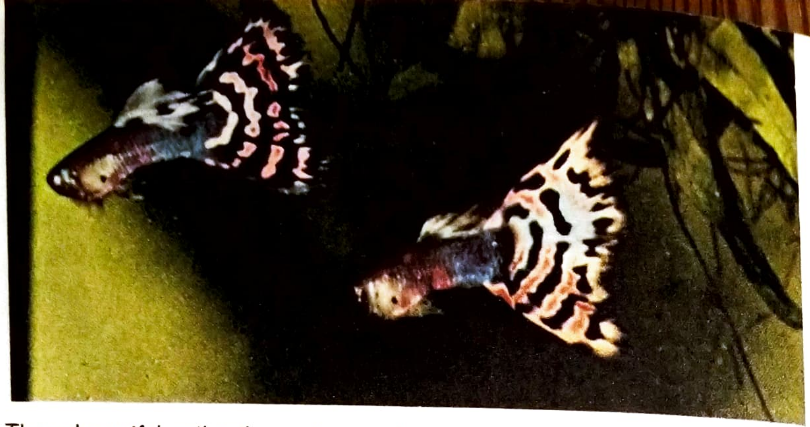
guppies, first bred in Vienna, in particular the lyre tail emerald guppies, which have taken prizes in many shows, are outstandingly popular. They are not necessarily so large a fish as the general run of modern breeds, but their patterning is exquisitely beautiful. Crosses between the emerald and fantail guppies produce flagtail, in which the tail is long, but not very wide, and in an ideal flagtail the horizontal markings should run parallel with one another. The fantail, veiltail, triangle or delta tail guppies are clearly closely related. All are fish with a wide V-shaped tail, extending to as much as a body's length behind the fish. The tail should have a minimum of irregularity in its shape, in particular it is ideally cut straight across at its posterior border. It and the body may be the same color, or they may differ. It is clearly more difficult to produce an approach to a uniformly colored fish in both body and finnage than to produce something more variegated. It would seem that breeders have very often picked out what nature has offered and improved on it as far as possible, to produce some very beautiful fish, such as the Hahnel red fantail, the Rohrmeser green fantail, the Schütz Variecolored fantail, the de Monte veil tails, and so forth. It is better to look at the accompanying illustrations to get an idea of the wonderful variety of guppies which are on present day offer than for the authors to try to describe in great detail what the eye can comprehend at a glance.

The more recent King Cobra veil tail guppy, is described in the May, 1965, issue of T.F.H. This guppy comes in several color variants and was developed at Mac Guppy Hatchery in the United States. The name comes from the snake skin markings that cover the entire body, which can be bred on to the typical blue, green, red or yellow strains now available, to give a new body marking to almost any strain. The development of the King Cobra guppy is an interesting story, illustrating the kind of points made in this booklet. Fifty-five tanks were allotted to the project of fixing various

strains of the newly discovered mutant. The finest of the new males available were crossed with virgin females of various other strains and careful records were kept showing which strains of females gave the best results (i.e., progeny testing). Selection was intensified for production of better markings, color and size, and after a period of 18 months the strain was developed to the point shown in the accompanying photographs. It is interesting that feeding at the hatchery is standardized at five times a day, and foods include newly hatched brine shrimp, Miracle Freeze-Dried Tubifex Worms, liver paste, beef heart and powdered foods, and all tanks are kept spotlessly clean through the use of regularly changed filters and catfish as scavengers. Water temperature is kept around the minimum advised by ourselves at 76°F. and, also, pH is slightly alkaline. No more than two guppies per gallon of water are ever kept in any one tank.

Guppy Clubs

Anyone becoming seriously interested in guppies will benefit enormously by joining an appropriate club. There may be sufficient interest in guppies in your local aquarium society to supply your needs, and those whose enthusiasm for guppies is such as to exclude most other fishes would be well advised to discover whether a specialized club is available in their neighborhood. It often will be. Guppy clubs perform a number of almost self-obvious functions and a member of a club should expect to progress, particularly if he is a beginner, very much more rapidly than would otherwise be the case. He will gain entrée to the homes of other guppy enthusiasts, gain advice from them and be able to exchange experiences and specimens. By comparison with their fish, he will gain information about the merits of his own, and he will also find a market for good surplus specimens.



These beautiful veil tail guppies caught everybody's attention at a show in Germany. Photo by Dr. E. Schmidt.

Members of guppy clubs can also hope to put through programs of a much more ambitious nature than any individual. This has been practiced quite widely with great success. One member may be responsible for the attempted development of good breeding males, while another may have the job of raising the females, testing them for color potential and then distributing them to club members. A third may be responsible for raising offspring from selected specimens for culling and then for distributing the males and females to others for topping off and breeding. If such a scheme is carried out in the attempted development of perhaps three or four different strains, a club of only a few dozen members can be fully occupied in such a cooperative venture. The club can also make a reasonable income for itself to maintain a library, show tanks and to pay the rent of a meeting place, none of which would be possible without the collection of relatively high membership dues upon members. Naturally, such cooperative activities do not prevent the individual breeder who has enthusiasm and sufficient room to press on with his own particular breeding schemes, but he would be well advised to cooperate in his club's activities at the same time as doing this. Clubs may also import new specimens from reputable sources abroad or interstate more profitably on a cooperative basis than if it were left to individuals.

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